The Chemical Age

OL LXVII 25 OCTOBER 1952 No 1737

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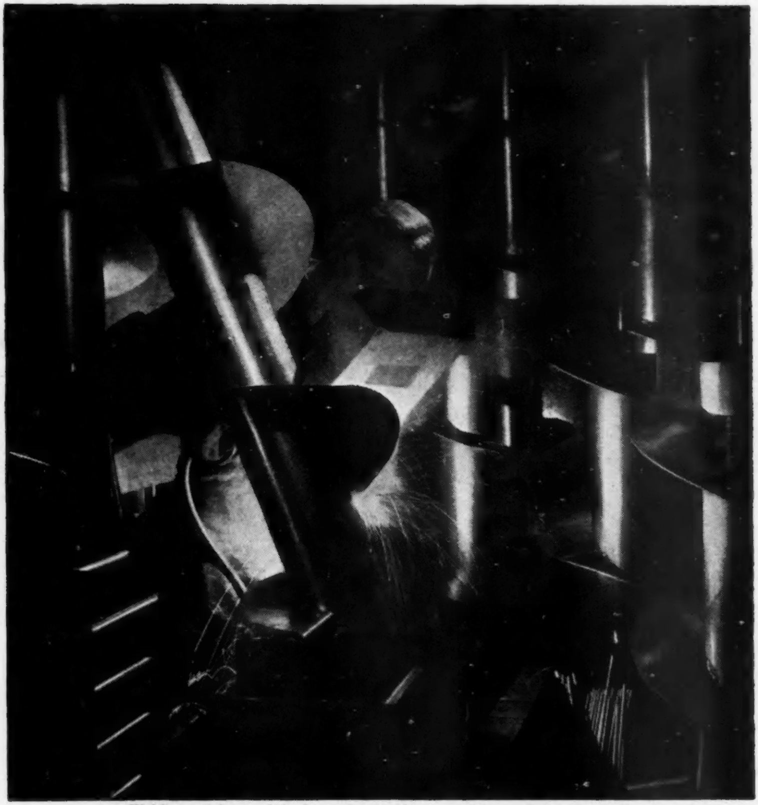

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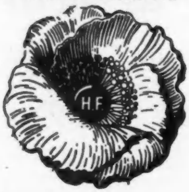

Poppy Day

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The Paper Problem

ANYONE making a serious effort to choose the three most momentous developments in mankind's history must plump for Caxton's invention of printing. But print is nothing without paper and all the gigantic machinery of Fleet Street would be silent and barren if the huge lorries with their outsize rolls of compressed cellulose disappeared from London traffic. For better or for worse modern civilisation has a paper foundation. The organisation of large modern populations would be impossible without it—the freedom of democracies and the controls of authoritarian states alike depend upon copious supplies of paper. These general remarks may seem commonplace enough but we are led to them by a recent paper in *Chemistry and Industry* (4 October, 1952) in which Mr. C. B. Tabb dealt with the manufacture of paper from agricultural residues. The world's increasing use of and dependence upon paper invests the technology of paper production with much more than technical interest.

The major source of cellulose for paper is, of course, wood. Theoretically the world's supply of paper is safely based upon renewable resources; in practice, however, true equilibrium cannot exist if trees are cut down faster than new trees can grow. Nor is equilibrium more than locally established if countries that can grow trees intensively develop abnormally high internal demands for paper pulp. Is it sufficiently appreciated that, as Mr. Tabb points out, North America produces and consumes two-thirds of the world's pulp production; and the whole of the non-dollar world is left to compete for the remaining one-third ? For countries without large forests or the land to develop them this is an unhappy and precarious situation. But cellulose is a universal substance, one of nature's most widely distributed structural compounds; other forms of vegetation than trees produce it and do so with a much greater rate of renewability. The development of non-wood sources of cellulose has certain technical difficulties, but the outside observer of the paper industry can hardly avoid wondering whether these are difficulties any greater than the initial growing pains of the familiar wood-pulp processes. In any industry where specific processes are well established the differences associated with fundamental changes are never easy to absorb. It is surely national folly for any country that relies upon imported pulp for much of its paper not to develop to the utmost its own agricultural residues as paper-making materials. Those residues must be grown whether or not they eventually become a medium for print; their production therefore does not make any

new demand upon land acreage. The cellulose in such residues is given its highest economic conversion if it can be extracted and re-arranged as paper.

Mr. Tabb's survey showed how the difficulties in developing paper-pulp from cereal straw and cane-sugar bagasse have been overcome. Attempts to use bagasse suffered many early set-backs; for 40 years the story was one of failure. But the impetus was always present for the producers of cane-sugar had in bagasse an unavoidable by-product whose only other use was as fuel and even this could dispose of no more than 60 per cent of it. The economic will was present and with persistence the technical way was found. Today some of the cane-sugar factories in the world have altered their boiler plant so that the fuel demand upon bagasse can be reduced to make more available for paper manufacture! Economically the case of bagasse is exceptional. It is a by-product containing cellulose fibres that must for other reasons be finally concentrated in quantity at factories. Cereal straw, though very similar as a technical material for paper-pulp, becomes a by-product on the farms. There are various other uses for it. Its disposal problem is not even at the worst of times as pressing as the bagasse disposal problem. The only impetus for private enterprise to develop straw as a paper-making material is that which develops in the paper industry when wood-pulp is scarce or expensive or when a gloomy long-term view for wood-pulp supply must be taken. Paper mills designed for using wood-pulp must be altered if straw-pulp is used instead. It is a heavy and possibly costly responsibility for private enterprise to assume if, not many years later, abundant supplies of wood-pulp and esparto become available at reasonable prices. Yet in the long run Britain as a nation should make the maximum use of all indigenous resources and the fullest development of cereal straw in paper or cardboard manufacture is an outstanding example. In Holland, perhaps of all European countries the most thrifty, there has long been a substantial straw-pulping industry and the proportion of straw used by industry has always been higher than here.

Recently the paper supply position in this country has become much easier. That is not to say that paper is cheap. Depression in the textiles industry has relieved some of the alternative pressure upon cellulose supplies; and the high price of pulp has reduced some of the paper-making demands of a world with less money to spend. Who can say how long this easier situation for paper can last? The trees are still being felled at a faster rate than they can be re-planted and reared and two-thirds of the world's wood-pulp is still being produced in the dollar area. Surely a greater effort should be made to salvage waste-paper and develop straw-pulping in the U.K.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d: post paid 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited.

Notes & Comments

Chemicals & British Economy

OF all the productive industries the most basic is probably the chemical industry, since there is no activity, including agriculture, which is not dependent for its existence to some extent on the use of chemicals. In any consideration of the future of Britain the importance of the chemical industry as a fundamental force in national economy must be appreciated. It is not surprising, therefore, to find that the chemical and allied industries form the basis of many of the proposals for a policy for Britain outlined in a series of articles 'Re-thinking Our Future,' which appeared recently in *The Observer*, and which have now been reprinted as a booklet (price 9d.). Chemicals, naturally, receive greatest prominence in the article on 'New Ways with Raw Materials,' in which reference is made to the scientific revolution of the last two decades which has been brought about by the artificial synthesis of many compounds previously found only in natural form. Progress is still going on, and Professor Steidl, of Pennsylvania, recently forecast 'an age of oxides, silicates, carbides, nitrides, and so on,' to follow the present age of metals. Britain must see that she is a pioneer in the industrial application of such developments. The article suggests that four main emergency measures should be adopted: prospecting, substitution, synthetic production and improved methods of use. Lack of technical resources, shortage of staff, and inability to tie up capital in long-term projects are serious considerations for private enterprise, and the proposal is put forward that the State should act as patron by creation of a new Department to the Treasury to give a frame to national economy in terms of raw materials. Other chemical aspects raised are the increased use of fertilisers in food production, the lack of attention paid to using the by-products of coal, and the importance of the growing oil-refining industry. The collection of these articles together enables a better appreciation of their value than when reading them singly, and the 'arduous but hopeful policy' outlined deserves serious attention.

Road to Abundance?

A BOOK to be published by McGraw Hill early in 1953 is *The Road to Abundance*, by Mr. J. Rosin, Director of Research of the Montrose Chemical Company. In an interview with the *Reader's Digest* for October, the author gives a preview of what the book is about. Mr. Rosin apparently takes the view that in the past we have depended too much on vegetable plant life on this earth for our food. Plants are, he says, incredibly slow, inefficient and wasteful beyond belief. Synthetics, he claims, have triumphed over agriculture in the fields of dyes, perfumes, rubber and drugs; also in textile fibres, possibly the greatest triumph of all. When it comes to food, progress in the three main kinds of food, carbohydrates, and proteins is such that the total synthesis of fats may be very near, and even proteins are gradually being conquered. Mr. Rosin points out that oleomargarine is not a substitute for butter: it is butter made by industry. Except that the industrial product is cheaper and more uniform, the two substances are practically identical. With natural food, Mr. Rosin admits that the problem is complicated by prejudice, and a feeling among the public that natural foods are better or more wholesome than artificial, but he remarks that in fact natural foods are often made unnatural or over-sophisticated before they reach our tables, especially in the realm of taste and appearance. Chemists will, he thinks, take these popular feelings into account when it comes to synthesising foods.

Ersatz

IT IS fairly certain that if chemists do not take into account popular feelings when they come to synthesise food, no one will eat the food. It is no use offering a man whale blubber mixed with ergosterol, carotene, vitamin B and so forth and telling him it will do him

as much good as 1 lb. of the best butter. It will not, as it happens, do him any good at all, because he will not eat it. The criterion by which people who are not actually starving judge food is taste, and until science can synthesise Lobster *Thermidor* and make it taste like Lobster *Thermidor*, it is a waste of time to insist that margarine is butter or as good as butter. Margarine does not taste like butter, and even Dr. Summerskill knows it. This is nothing to be ashamed of, however, because despite Nature's apparent inefficiency, slowness, and waste, she has managed to produce out of the world's most elementary constituents a glittering profusion of the most varied foodstuffs by a process so elegant in its simplicity that science has not yet been able to approach it. Science's usefulness surely lies not in making *synthetic* foods so much as developing new sources of supply of *natural* foods, or increasing the yields of natural foods. Synthetic chemistry has not yet, and never will, equal Nature in profusion, although it may equal it in quality. Thus, although in the field of artificial fibres man has made fibres which are superior to wool and cotton in many ways, not one of them will ever be more plentiful than wool and cotton. In the field of foodstuffs, moreover, synthesis has other limitations. Most foods needed by higher mammals (including ourselves) are so complicated that it is simply not worth synthesising them as a source of food. Synthetic beef, even if it were possible, would be so complicated to produce that it would be easier to put the effort into growing cows, since animals are the best chemical factories known to man. Raw materials are another fundamental problem in chemical synthesis, and until we can learn to use more plentiful ones than we do at present, our efforts to produce more food will be better devoted to assisting Nature than to replacing her.

Philblack, Ltd.

At the annual meeting of Philblack Limited held in London on 14 October, Mr. T. A. McKenna, deputy-chairman, said that since the end of the company's year on 31 March, it had continued to operate at a loss.

Up to last January sales had steadily risen to between 55 to 60 per cent of designed capacity. There had, however, been no further improvement due to the recession in the rubber industry and to the substantial stocks of carbon black held by the Government and industry.

Describing the first year's operations as most disappointing, Mr. McKenna said it was feared that there was no chance of altering the position during the current year. He was confident, however, that when trade improved there would be sufficient demand for the company's products to justify the original capacity of the plant. Selling prices had been lowered although costs of raw materials had risen but alternative sources were being arranged which should render operations profitable on sales of 75 per cent of capacity.

A 40-ton vacuum flash tower seen off Green Hithe in the Thames as it starts off on the first leg of its 400-mile sea journey to Anglo-Iranian's refinery at Grangemouth

Advantages of Glass in Chemical Plant

Trend Towards Use of Smaller & More Flexible Units

GLASS for industrial equipment, particularly chemical plant, was for some time regarded with prejudice because of the limitations of the various methods of processing. Developments in the design of glass plant units and production methods were, however, greatly advanced during the last war, when many other materials normally used were in short supply, and the advantages of glass in plant are now properly appreciated by the chemical industry.

A survey of glassmaking from its earliest origins thousands of years B.C. to its latest applications in heavy industrial plant was given by Mr. B. H. Turpin, technical and sales director of Quickfit & Quartz, Ltd., Stone, Staff., in his paper on 'Glass as a Material of Construction in Chemical Plant,' delivered in Rotterdam on 23 October to members of the Chemical Engineering Group of the Royal Institution of Engineers of Holland.

Beginning with a brief historical outline, Mr. Turpin showed how the first outstanding advancement was attributed to the Phoenicians who used a blowing iron some 150 cm. long which is virtually identical with that used in the glassblowing technique of today.

Definition of Glass

The definition of glass is still a subject for argument (Mr. Turpin said) but it is generally considered first as 'a physical condition,' known as 'the glassy state,' having a molecular structure something between the amorphous and the crystalline.

For convenience the composition of glasses are always quoted in terms of the oxides of the constituents found therein by analysis. Common 'soft soda' glass contains approximately 68 per cent SiO_2; 4 per cent Al_2O_3; 0.7 per cent B_2O_3; 5.5 per cent CaO; 2.2 per cent Mg.O; 17 per cent Na_2O; 2.2 per cent K_2O; and has a linear coefficient of thermal expansion between 0°C. and 100° C. in the region of 0.00001.

Borosilicate glasses, commonly known as 'heat resisting glasses' and used for commercial ovenware, contain approximately 80 per cent SiO_2; 12 per cent B_2O_3; 2.7 per cent Al_2O_3; 4 per cent Na_2O; 0.06 per cent Fe_2O_3; 0.12 per cent CaO; and have linear coefficients of thermal expansion approximating to 0.000003, or approximately ¼ that of steel.

Three essential types of processed glass are required by the chemist and chemical engineer: (a) tubing; (b) blown mouldings for storage vessels, reaction and still vessels; fractionating columns, and so on; (c) glass pressings accurately produced in quantity to standard shapes. These may have to be fitted into metal frames or associated with metal flanges, such as pipe flange ends or bottles with screw tops.

Hand-Drawing of Tubing

Hand-drawing of tubing calls for much skill from the team of workers to ensure accurate control of diameter and wall thickness. Various types of machine have been devised for producing glass tubing in quantity, and it is reasonable to expect a more uniform product from the machine than from the hand-makers.

Once set up, however, the machine produces tubing at a very considerable rate, so that the market for any particular size has to be fairly large to be economic. Handmakers can modify their technique to produce, in a given shift, quite a number of different diameters of tubing. In the manufacture of scientific glassware and chemical plant, while a wide range of sizes and wall thicknesses may be required, the quantities may not be very large, so that machine methods are not so suitable.

After describing various other forms of glass working including flasks, vessels and cylinders and glass pressings for ovenware, glass pipeline flange ends and so on, Mr. Turpin described the methods of fabrication and showed how unequal strains in glass are removed or reduced to unimportant proportions in an annealing kiln or lehr.

An essential feature of a glass to be used by the chemical engineer is that of good resistance to thermal shock. The risk of accidental mechanical breakage on a plant can be tolerated, since such a failure can be explained and precautions taken to prevent its recurrence. Fracture of glass units during raising and lowering of temperature without apparent explanation cannot be

tolerated, however, as the duration of the plant would be unpredictable.

Although the thermal conductivity of glass is extremely low (300 times less than that of copper), this is largely compensated by the less adverse surface film effects. Where glass surfaces inhibit scale formation a metal surface deteriorates and shows a continued falling off in performance as it corrodes.

Applications of Glass to Plant

To illustrate some of the advances in the application of glass to industrial plant, Mr. Turpin gave some examples of units developed by his company. One of the most successful is the glass heat exchanger with its battery of coils sealed into a jacket. Light and compact it is only a small fraction in size and weight of its metal equivalent. The standard unit (15 cm. diameter) is capable of condensing steam to water at the rate of some 73 litres an hour, while the 30 cm. diameter unit can condense 113 litres an hour.

Condensers made by Quickfit & Quartz are claimed to be the first real solution to the problem of providing a plant-scale condenser in glass. The special cooling-coil assembly utilises the available space to the full.

The largest glass vessel at present commercially available is of 200-litre capacity, and the largest glass pipe and fractionating column is of 45 cm. diameter. The combination of glass pipes, vessels, heat exchangers and other units can provide a range of chemical plant from pilot scale to full-scale in many fields of industry.

In chemical plant design the modern tendency seems to be towards the use of smaller, more efficient and flexible units, rather than towards large single-purposed units. This feature is, of course, favourable to glass since the size of vessels is obviously limited.

A quick survey of the applications of glass in commercial production was given by Mr. Turpin as follows:—

Glass pipelines are used in chemical manufacture for conveying corrosive fluids, strong acids, both gaseous and liquid, and in food manufacture for conveying fruit juices, sauces, vinegar, milk and alcoholic and other beverages.

Glass condensers for the distillation and reflux of corrosive chemicals, acids, drugs and pyrogen-free water; the recovery of solvents often containing dissolved acids, and the recovery of alcohol from fermentation vats, and so on.

Glass boilers and heaters for the preheating of corrosive liquors feeding to stills or vats, as evaporators on continuous stills, and for heating liquids for large batch stills. They are used as flash evaporisers for purposes including the sterilisation and concentration of fruit juices.

Glass stills of batch or continuous types are used in the production of corrosive chemicals, fine chemicals, drugs, essences, flavourings and the recovery of solvents.

Glass extractors and absorption towers for liquid/liquid or liquid/solid extraction for gas liquid scrubbing and for gas absorption.

A development in the manufacture of sulphuric acid which has shown considerable savings in cost in the production of analytical quality acid, is the use of glass towers for the absorption of sulphur trioxide from the vanadium catalyst plant to produce pure acid in one process. Sulphuric acid (98 per cent) is circulated through a glass absorption tower using an air-lift pump, distilled water added for make-up, and filtered SO_3 admitted to the base of the tower. Plant dealing with some 35 tons a week has been constructed in this way.

In chemical plant which calls for large vessels, vitreous enamelled metal vessels are, in many cases, used in conjunction with glass fractionating columns, condensers, and other ancillary gear, and considerable savings in cost are affected by the durability of the glass and the visibility of the processes.

In concluding his address Mr. Turpin summarised the three outstanding advantages of industrial plant in glass, as follows:

Resistance to corrosion.—Glass eliminates corrosion and its resultant maintenance costs. The efficiency of condensers and heat exchangers remains unimpaired since no surface roughness develops as with metals.

Purity.—Glass enables laboratory conditions of purity and cleanliness to be maintained on production scale. Cleanliness of the plant at the start of production and at change-over from one process to another can be ensured by visible inspection.

Visibility.—The transparency of glass equipment enables plant control to be effected visually as in the laboratory, while contents and internal processes may always be visually observed and products examined for colour and clarity.

International Analytical Symposium

Report of Birmingham Meeting—II

IN THE CHEMICAL AGE of 11 October, summaries were given of papers read and discussed during the international symposium on analytical chemistry held at the University of Birmingham on 11 and 12 September. This concluding article presents summaries of papers dealing with original methods.

Enhancement of the Reducing Properties of Metallic Mercury in Presence of Thiocyanate and Cyanide: Its Analytical Applications; by F. Burriel-Marti.

In neutral and acid solutions metallic mercury is a very weak reducing agent, unsuitable for analytical purposes. In the presence of ions forming precipitates or complexes with mercuric or mercurous ions, however, this reducing power is enhanced. The classical example is the enhancement in the presence of hydrochloric acid, enabling ferric, vanadic and other ions to be reduced quantitatively. This reaction is the basis of certain methods for the determination of these ions. One of the main detractions of this reduction is the formation of a precipitate of mercurous chloride, which yields a colloidal suspension with the metallic mercury, and makes the separation of the reduced solution a troublesome process.

Another possibility, which has not been exploited as yet, is the enhancement of the reducing power of mercury in the presence of ions forming stable complexes with it.

The mercurous ion does not form any suitable complexes, but the mercuric ion forms several, the most promising being those with thiocyanate and cyanide. In the presence of these, metallic mercury acts as a strong reductor.

The mercury-thiocyanate complex can be used for the reduction of ferric iron, and this is perhaps its most important application. The reaction takes but a few seconds, the solution being quite colourless at the end of this time. The presence of air does not interfere. This method has certain advantages over zinc and cadmium amalgam reduction procedures, as with these the reduction of ferric iron is only complete in the absence of air. The great speed of reaction may be due to catalysis by the thiocyanate ion.

The most important analytical applications of the reaction are for the reduction of ferric iron prior to the use of some other analytical process (separation, absorptiometric determination, titrimetric determination, etc.).

Quantitative reduction is ensured, as the thiocyanate acts as an indicator, thus eliminating the errors due to incomplete reduction. Ions which are weak reductants do not interfere.

The mercury-cyanide system is strongly reducing in alkaline solution. Since mercury cyanide is a very stable complex, the concentration of cyanide in the solution is not of great importance, provided there is enough present to form the complex.

The main disadvantage of this reducing system is the presence of cyanide in the solution. The reduction of certain oxidising systems has been studied. The reduction of ferricyanide to ferrocyanide is of interest in that it is quantitative in a few seconds, and the reaction can be applied to the titrimetric determination of ferricyanide.

Atmospheric oxygen is reduced to hydrogen peroxide, and must be absent.

A New Reagent for the Direct Determination of Water; by T. S. West.

The determination of water is an essential part of many analyses. Numerous methods are available for this determination, the majority of which, however, are dependent on the measurement of a physical property of the system.

Few chemical methods are available for the determination of water, most of which are, in effect, methods for the determination of active hydrogen. These are mainly evolution reactions involving the measurement of a gas volume.

Titrimetric methods are less common. The liberation of ammonia gas from sodamide or magnesium nitride and its subsequent acidimetric determination has been used by some workers. Again, the hydrolysis of certain organic compounds such as α-naphthoxydichlorophosphine and its oxide, cinnamoyl chloride, and acetic anhydride has also been used. However, most of these methods are time-consuming and are subject to variation

with experimental conditions. None of them is stoichiometric, and few have found widespread use, mainly because the well-known Karl Fischer procedure is superior to all. The Karl Fischer reagent consists of a solution of iodine, sulphur dioxide and pyridine with the last two in considerable excess, so that the effective strength of the reagent depends solely on its iodine content. Many attempts have been made to improve the reagent, but little, if any, improvement has been effected over that originally proposed in 1935. As the Karl Fischer is really the only titrimetric reagent for water, its limitations are of particular importance. Its stoichiometry is only 80 per cent of theoretical, and after one month this falls to 50 per cent. Consequently, the reagent must be standardised daily. A potentiometric procedure must be applied to detect the end-point.

The present author has examined more than fifty reactions in a search for a new method for the determination of water. One of the more obvious developments is the substitution of bromine for iodine in the Fischer reagent. The reagent finally recommended by the author consists of a solution of bromine and sulphur dioxide in chloroform together with a solution of pyridine in the solution of water to be titrated. The reagent furnishes a method for the determination of water which is as good if not better than the Karl Fischer reagent. The stoichiometry of the reaction is 90 per cent. The reaction is extremely rapid and the visual end-point is excellent. The change in potential at the end-point is greater than the change obtained in the Karl Fischer procedure.

The only detraction from the value of the method is the fact that the reagent reacts with alcohol, but dioxan can be used with advantage as a solvent for water. The reagent is more stable than the Karl Fischer reagent.

A New Reagent for the Precipitation of Sulphate; by D. Gibbons

The classical method for the determination of sulphate by precipitation as the barium salt is subject to co-precipitation errors. In particular, the nitrate ion interferes and must be removed by evaporation with hydrochloric acid. The only alternative method of precipitation which has received much attention is that of using benzidine sulphate, but the comparative solubility of the precipitate, together with the disturbing effects of other ions, renders it suitable only for work where great accuracy is not important. The only other method recorded uses precipitation as the complex hexammino cobaltic bromide sulphate, but further studies of this method are not available.

Five other co-ordination compounds of cobalt, which are recorded as having difficultly soluble sulphates, have been examined as possible reagents. Of these, octammino μ-amino-μ-nitro dicobaltic nitrate has been found to give quantitative recoveries over the range 1-100 mg. of sulphate.

The ions, Na^+, K^+, Ca^{2+}, F^-, Cl^-, NO_3^-, as well as peroxide, do not interfere, even when present in 200 mg. amounts, but phosphate interferes unless the pH is adjusted to between 4 and 5. At this level, Fe^{3+} and Al^{3+} still interfere by hydrolysis. Tartrate, citrate and fluoride ions will complex the latter two metals, but the complexes formed give precipitates with the reagent. Ethylene diamine tetra-acetic acid will, however, complex them satisfactorily without interfering with the precipitation.

A New Reagent for the Determination of Antimony; by D. Gibbons.

The two most widely used weighing forms available for the determination of antimony are the tetroxide and the trisulphide. Both have the disadvantage of providing unfavourable weighing factors, and it is necessary to use carefully controlled conditions to obtain products which conform to the stoichiometric composition. Certain other weighing forms have been proposed, but have not come into general use, possibly because information is not available concerning the interfering effect of other metals on the precipitation.

The compound, dichloro-bis-ethylenediamine cobaltic hexachloric-stibnate, is reported as being insoluble in water and hydrochloric acid. This has been investigated, and the results show that transdichloro-bis-ethylene diamine cobaltic chloride hydrochloride can be used as a gravimetric reagent for antimony, quantitative recoveries being obtained over the range 1-50 mg. of antimony. The antimony content of the precipitate is only 20.98 per cent, thus providing a favourable weighing factor.

Arsenic, zinc and copper do not interfere; cadmium, iron, tin and mercury interfere

above 100 mg.; bismuth interferes above 10 mg. and lead interferes at all concentrations. Even so, the reagent may be said to be fairly selective, and has been applied to the determination of antimony in a white metal, after a preliminary separation of the interfering metals present.

A Study of Three Suggested Reagents for the Detection of Potassium; by R. J. Winterton.

Three reagents, which have been proposed for the detection of potassium, have been examined further, as details of sensitivity and interferences are not given in the original papers. The reagents are sodium cobaltithiosulphate, sodium calcium ferrocyanide and sodium uranyl chromate. The object of the study was to determine the sensitivity of each reagent towards potassium in pure solution, the reaction between the reagents and other cations, and the effect of other cations on the sensitivity of the reagents towards potassium.

Some of the findings may be summarised: The sodium cobaltithiosulphate reagent is sensitive to 3 mg. per ml. of potassium, but is slightly more sensitive towards rubidium. The reagent does not give the characteristic sky-blue precipitate with the other alkali metals, ammonium and alkaline earths, although a white precipitate of barium thiosulphate is obtained with barium. The sensitivity of the reagent is not affected by concentrations of lithium and ammonium ions up to 10 times that of the potassium ion.

The sodium calcium ferrocyanide reagent gives white precipitates with rubidium, caesium and ammonium ions, but only when these are in concentrated solution. No reaction occurs with solutions of lithium, strontium, barium or magnesium.

The sensitivity of the reagent towards potassium (0.8 mg. per ml.) is not affected by a ten-fold excess of lithium.

Sodium uranyl chromate will detect as little as 0.8 mg. of potassium per ml., and, if the reagent test solution mixture is allowed to stand overnight, 0.5 mg. of potassium per ml. can be detected. Similar precipitates are given with rubidium and caesium. Barium gives a yellow precipitate of barium chromate. Lithium, magnesium, ammonium, calcium and strontium do not give precipitates. The sensitivity of the reagent towards potassium is not affected by a ten-fold excess of lithium and ammonium ions.

None of the reagents is as sensitive towards potassium as sodium cobaltinitrite, but it is possible that sodium cobaltithiosulphate may prove useful for the detection of potassium in the presence of ammonium, and for the detection of rubidium in the absence of potassium. Sodium uranyl chromate may prove useful for the detection of potassium in the presence of ammonium.

Alizarin Blue as a Selective Reagent for Traces of Copper; by F. Feigl.

It is now generally accepted that the specific and selective action of organic reagents depends upon the presence and position of certain atom groups. These groups are salt-formers capable of forming co-ordination compounds with metals. It has been possible during the past several years to obtain a better understanding of the action of what are now well-known reagents, as well as to find organic compounds which can be used as new precipitating, colour and masking reagents. In addition to the presence and position of certain groups, which determine to a large extent the analytical value of an organc compound, several other factors are of importance. Thus, the behaviour of the reagent and reagent products towards solvents, the *p*H, the temperature and other essential reaction conditions must be closely studied. Furthermore, it is essential to analyse the influence of other atomic groupings present in the reagent molecule. Such groups are often capable of changing the solubility or colour of the molecule, as well as its basic or acidic character.

In view of these facts, it seemed of interest to examine the behaviour of an organic compound, the molecule of which contains two characteristic atom groups. Such a compound is the blue-red dyestuff Alizarin Blue, which possesses the characteristic groups present in the alizarin and oxine molecules. If the activities of its functional groups are unchanged, Alizarin Blue should possess the analytical properties of both these molecules, and should form colour lakes and inner complex salts. This is not quite so, however, as Alizarin Blue has no longer acidic or basic properties. The functional groups in the molecule probably undergo interchelation.

Alizarin Blue is soluble in alkali bisulphite solution and in concentrated sulphuric acid, but is insoluble in the common organic solvents, and it is thus virtually impossible

to compare its analytical properties with those of alizarin and oxine. Two indications, however, point to the fact that Alizarin Blue still shows analytical properties of both compounds. Thus, it has long been known that it will precipitate a blue copper salt from strong sulphuric acid solution. It also forms colour lakes with strongly acidic solutions of zirconium and hafnium salts.

In order to use the formation of copper Alizarin Blue for the detection of copper it is essential to prevent co-precipitation of the dye, as well as to avoid the colour masking by the reagent of small quantities of the precipitated salt. To overcome this difficulty, a saturated solution of the dye (0.2 per cent) in pyridine is prepared, evaporated to dryness and then treated in such a way that when copper is present, the residue is blue in colour, giving a spot test for copper which is much more sensitive than all previous tests for copper. When copper is absent, the residue is colourless. Under these conditions, only nickel interferes. The limit of identification is 0.0025 μg. of copper.

Some Developments in Spectrochemical Methods; by R. L. Mitchell.

It must be emphasised that spectrochemical analysis is not the solution to all analytical problems. It can often make a qualitative examination in a few minutes and provide an answer, which by other methods may take hours; in certain circumstances it can provide routine quantitative analysis far more expeditiously and sometimes more reliably than other analytical techniques. Its advantages generally lie in the simultaneous determination of several constituents in a series of samples. It is, unfortunately, rather a specialised technique requiring considerable equipment and some experience.

Recent years have seen a great development in the use of the flame as a source in spectroscopy, particularly in conjunction with photoelectric devices for the assessment of intensity; in general, these methods are for the determination of sodium, potassium and calcium in solutions containing of the order of 1 μg. per ml. Numerous instruments are now available for this purpose, using prisms, gratings, absorption filters and interference filters to isolate the spectral lines, and various types of photoelectric cells and photomultiplier tubes, with or without further electronic amplification.

It is becoming realised that all electrical discharge sources are essentially of the arc type, with differences in duration and current density controlling the effective temperature of the discharge. This has led to the development of a series of source units which can supply any type of discharge from direct current to high frequency spark by way of the newer triggered alternating current arcs, and which enable a suitable discharge type to be selected for any specific problem. Such source units are now commercially available.

One factor of considerable importance in quantitative work is slit width, and an easy and accurate method for measuring this has recently been suggested. A paper, now in press, describes a method for measuring slit width. Briefly, the method consists of examining a pair of offset fixed slits in monochromatic light through the spectrograph slit and counting the interference fringes. The width can be found accurately in a few seconds.

With regard to equipment of more direct interest to general spectrochemical analysts, there has been an interesting application of the cathode-ray tube in order to present an intensity scan of a spectrogram, similar to that given, much more slowly, by a recording microphotometer. The use of this technique is in the evaluation of very weak lines on an appreciable background and of lines which appear as shoulders on stronger neighbouring lines.

Technique of Feldman

The porous cup solution spark technique of Feldman (1948) involves the introduction of solution into the spark gap while the determination is in progress. Feldman's technique is extremely simple and elegant and is much more generally applicable than previous methods. The present author favours a carbon electrode in preference to the graphite electrode of Feldman and other workers, as it has the advantage of not requiring any preheating or pre-sparking to render the base porous. Since the original work, more than 20 papers employing the method have appeared. Scott, in as yet unpublished work, obtained sensitivities for many elements as least as good as other workers, despite using only one-third of the volume. Beryllium and magnesium gave great sensitivities (0.01 μg. per ml.) and elements such as arsenic, antimony, tungsten, mercury, tellurium and phosphorus, all of

which are difficult in the arc discharge, gave reasonable sensitivity.

*An Electrochemical Method of Gas Analysis;** by P. Hersch.

When an electrical battery is allowed to run down, the ampère-hours obtained are determined by the amount of only one of the electrode reactants. Conversely, the quantity of this reactant can be found from the capacity of the galvanic system. This technique differs from coulometry in that no extraneous source of current is required and no potential limit can be over-stepped. The term 'galvanic analysis' may be coined for this method.

An example is the recently described determination of small traces of oxygen in hydrogen or nitrogen. The galvanic system Gas/smooth Pt/KOH/Pb was used. It is important that the Pt cathode is only half-bathed by the electrolyte. This enables the oxygen to ionise readily and quantitatively. With the conventional type of gas electrodes the depolarising gas must diffuse through at least a thin film of liquid, even when agitation is applied. On a semi-immersed cathode, oxygen molecules are adsorbed on the emerging part and quickly reach the electrolyte by surface diffusion. That liquid diffusion is then not rate-determining can be shown by decreasing the partial pressure of oxygen. Instead of a proportionate decrease of current, no decrease is observed, except at very low partial pressures such as 10^{-4} or 10^{-5} atm., when gaseous diffusion becomes the slowest process.

The oxygen depolarising power of a semi-immersed metal often gives rise to destructive effects known as water-line corrosion. The same phenomenon is beneficial and essential in the air-depolarised batteries of the type Air/porous Carbon/NH_4Cl (or KOH)/Zn. The carbon must be water-proofed so that the electrolyte does not penetrate the pores completely. Menisci are formed inside the pores adding up to a considerable total length of water line receiving the oxygen.

The galvanic determination of oxygen was first suggested with carbon electrodes of this type. The author finds, however, that suitably shaped metal cathodes make it possible to cover a range 100 times smaller than has been claimed recently and a much wider field of industrial and scientific applications seems now to open for this type of oxygen meter.

Hydrogen does not interfere with the cell. The H_2 molecule is galvanically sluggish because unlike O_2, it must dissociate before ionisation can occur.

With half-bathed metal cathodes the continuous measurement of extremely low oxygen contents, of a few parts per million, becomes possible. In the Development and Research Laboratory of the Mond Nickel Co., Ltd., a prototype apparatus has been built which is inexpensive and has no moving parts. It is calibrated with oxygen generated in a micro-electrolyser. While integration is necessary in the static method, the oxygen content is here indicated as galvanic current, and may be continuously recorded.

It seems likely that galvanic methods will emerge for gases other than oxygen, and not necessarily for gases only.

The Sensitivity of Analytical Reactions and the Selectivity of Some New Organic Reagents; by J. Gillis.

This paper recapitulated the work that has been done, since 1938, by the author and his co-workers, for the Commission on Analytical Reaction of the IUPAC.

In the first part, the definition and graphical representation of the sensitivity of analytical tests were given in detail. Diagrams pA, pC at constant pB are very useful not only in analytical chemistry, but also in many other spheres. They give the relative amounts of each constituent as well as the percentage and the concrete amounts of each mixture; they are superior, for dilute solution and trace analysis, to the classical diagrams relating percentage to a given physico-chemical property.

They allow also the representation of sample-lines of constant weight.

Sensitivity-diagrams describe all the quantitative aspects of one or different tests in the presence of attendant substance. They are also a good basis for the understanding of the principle of the semi-quantitative analysis of a constituent A, in a mixture A+B+C, by diluting the solution until a definite analytical test becomes negative.

In the second part the reason for the creation of the Commission on Analytical Reactions was retraced.

New derivatives of organic compounds containing characteristic groupings were synthesised and the conditions were studied

* Thanks are due to the Mond Nickel Company Limited for permitting this communication.

to enhance the selectivity and the sensitivity of definite analytical tests.

A comparative study of synthesised fluorones proved fruitful in connection with the analytical chemistry of germanium, from a practical as well as from an academic standpoint. 3,3′-Diaminobenzidine was studied specially for the identification of selenium in the presence of tellurium.

An investigation of polypyridyl and phenanthroline compounds, which contain the ferroin-reaction group =N—C—C—N=, but give no coloured compound with the ferrous ion, has been carried out by Hoste, on the intensely coloured compounds formed with the cuprous ion. The name 'Cuproine' was given to 2,2′-diquinolyl, a compound easy to prepare and a very attractive copper reagent.

Hoste demonstrated that a complex CuL_2^+ is formed, and studied extensively the absorptiometric determination of copper by extraction in organic non-miscible solvents.

In the same way he used 3,5,6,8-tetramethylphenanthroline for the extraction of iron in *iso*amyl alcohol or in chloroform, allowing its determination at very low concentrations.

A survey was given of the most recent researches on the iron 'specific' and the copper 'specific' groupings contained in polypyridyl, phenanthroline and cinnamoyl derivatives, indicating that predictions are possible regarding the structure of the ligand. In devising new analytical reagents empiricism will no longer be the guide.

Some Observations on the Direct Determination of Oxygen in Organic Compounds; by J. Unterzaucher.

The method for the direct determination of oxygen in organic compounds, as described by the author in 1940, was introduced at the same time into daily routine use in the organic analytical laboratory of the Farbenfabriken Bayer, Leverkusen. This method, which is based upon thermal decomposition of the sample over heated carbon and iodometric titration of the carbon monoxide formed, has been reported by various investigators as satisfactory, and an increasing number of laboratories, particularly in the United States, are now using it as a routine. It has also been successfully used by Chambers (1948, 1950) for the direct determination of oxygen in rubbers, giving results better than those obtained by the usual difference calculation, although a small blank correction has to be applied.

Certain laboratories encountered considerable difficulty with this method in its final step. It must be remembered, however, that as early as 1940, the present author succeeded in reducing the blank to a negligible value.

The apparatus now used differs from the original in that it incorporates a more effective nitrogen purification unit, making it possible to use ordinary commercial nitrogen instead of the more costly pure nitrogen. In addition, there is a Pregl gas pressure regulator, making it unnecessary to maintain a frequent check on the nitrogen flow rate.

The reaction tube is cleaned by treating with 40 per cent hydrofluoric acid for one hour. When treated in this way, reaction tubes become extremely clear and show no detectable reaction between the quartz material and the properly prepared contact carbon at the working temperature of 1,120° C. Trace amounts of metals are apt to shorten the service life of the reaction tube.

High results are obtained if the temperature rises during an analysis and low results if the temperature drops.

The oxidation tube containing the iodine pentoxide reagent is kept at a temperature of 118°C. by a glacial acetic acid heating bath. Commercial iodine pentoxide does not always meet the standards required for giving a negligible blank value. Certain samples of iodine pentoxide may be purified by recrystallisation from strong nitric acid. It has been observed during such purification of iodine pentoxide that colourless crystals are obtainable by recrystallisation of iodic acid or dehydrated iodic acid from strong nitric acid, the composition of which corresponds to anhydroiodic acid, HI_3O_8. This substance is very stable, and has proved to be a reliable and satisfactory reagent for the determination of carbon monoxide for the direct determination of oxygen.

Fluorine and phosphorus cause considerable interference in the determination, and also the apparatus may be seriously damaged.

It may be pointed out that the secret of success in the direct determination of oxygen lies in the use of pure reagents and perfect materials. The method has proved to be satisfactory and reliable, and provides an accuracy at least equal to that of existing organic microanalytical procedures.

Pneumatic Conveying in Horizontal Pipes

Investigations at Imperial College

THE nature of the flow of a two-phase solid-gas system in a closed conduit will, by reason of the large density difference of the components and the energy exchange mechanism, depend to a great extent upon the inter-relation of the physical properties and dimensions of the two phases. Thus, the presence of solid particles in a gas stream will modify the velocity gradients and the degree of turbulence associated with any particular environment.

Since, moreover, the maintenance of steady conditions will depend upon the mixture behaving as a homogeneous fluid, there will, in the case of horizontal transport, be critical velocities below which segregation of the solid phase, under the influence of gravity, may be expected to alter profoundly the characteristics of flow.

A paper dealing with some of these factors in so far as they are relevant to the operation of pneumatic conveying in horizontal pipes was presented by R. H. Clark, Ph.D., D. E. Charles, B.Sc.(Tech.), J. F. Richardson, Ph.D. (Associate Member), and D. M. Newitt, D.Sc., F.R.S., past president, at a meeting of the Institution of Chemical Engineers held in London on 14 October.

Number of Investigations

There have been a number of experimental investigations into the operation of vertical and horizontal pneumatic conveyors, the most comprehensive being those of Cramp and Priestley,[1] Gasterstädt,[2] and Segler,[3] and more recently by Wood and Bailey,[4] Farbar,[5] Zenz,[6] and Vogt and White.[7]

The present work, of which a review is summarised below, was begun at the Imperial College in 1946. Its object is to study the various parameters of solid-air flow, and to obtain therefrom data for the design and operation of pneumatic conveying plant. Part I is concerned with observations on the characteristics of such flow and the analysis of the pressure drops obtained in the system.

In a horizontal conveying system the whole of the energy expended in transport must originate in the air stream. The total pressure drop in the system can be separated into two parts; that due to frictional losses associated with the air itself, and the additional losses occasioned by the presence of the solid.

Effect on Air Friction

It has usually been assumed that the presence of the solid does not affect the air friction, but this may not be quite correct, because the degree of turbulence of the fluid and the pressure at any point in the system will be influenced by the presence of the solid. Furthermore, only part of the cross-section of the tube will be available for air flow if the concentration of solids is high.

Additional pressure drop arises because energy is continuously transferred from the air to the particles, first in order to overcome inertia and to accelerate the particles, and secondly to compensate for energy losses occurring when particles collide with the wall or with each other.

Since the drag force on the particles is a function of their relative velocity in the air stream, the rate of transfer of energy will be a maximum when the particles have to be accelerated from rest, and will gradually decrease as the velocity of the particles increases. The air is continuously accelerating because the pressure falls progressively throughout the system, and the particle therefore never attains an equilibrium velocity.

This effect is not very important in the present work, however, as the pressure drop in the conveying section of the plant is only a small proportion of the total pressure.

The early part of the experimental work was carried out in a small horizontal conveyor with a straight 16 ft. length of 1 in. diameter brass pipe. Air from a rotary blower was passed through a coke filter to remove oil mist, and the flow rate was regulated by means of a system of control valves and measured with an orifice meter. The solids were introduced into the transport line, through one of a series of metering cones, from a cylindrical feed hopper fitted with a connection to equalise the pressure across the bed of solids.

Pressure measuring points were situated one ft. upstream and two, five, 10 and 16 ft. downstream from the feed point. The

behaviour of the solids could be observed in a sight glass, which consisted of a glass tube of the same diameter as the brass pipe. The solids were separated from the air-stream in a cyclone separator at the downstream end of the plant.

Measurements of the pressure at each tapping were made for the passage of air alone, and also during the transport of a number of different seeds, including cress, rye, rape, turnip and radish. Visual observations were made in each case at the sight glass.

Comparison of Pressure Drops

Comparison of the pressure drops between consecutive tappings in the line showed that the fall in pressure per unit length of pipe became less as the distance from the feed point increased. This was attributed to the fact that the particles were nowhere fully accelerated in this plant.

It was therefore decided to build a new unit with a straight length of transport line of 45 ft. for the subsequent experimental work. This was the maximum length which could be accommodated in the laboratory.

An apparatus was designed so that pressure measurements could be made at intervals along the conveying line and the solid velocity obtained at selected points. A 1 in. diameter brass line was again used; it included two straight lengths of 45 ft. in addition to a number of bends.

The equipment consisted of five separate items: (1) air supply unit; (2 feed hopper and feed control mechanism; (3) conveying pipe; (4) cyclone separator; and (5) an isolating section for the measurement of solid velocities.

Aluminium, brass, coal, cress seed and 'Perspex' were used in the investigation. Their densities were determined by a specific gravity bottle method, and their sizes by sieve analysis.

In addition, the air velocities required to maintain particles of cress and 'Perspex' in suspension in a vertical 1 in. diameter tube were determined; values of 17.5 and 10.2 ft./sec. respectively were obtained. Under these conditions the values of the Reynolds Group with respect to the tube and the particles were as follows:—

	With respect to tube	*With respect to particles*
Cress	9,600	420
'Perspex'	5,600	230

A series of experiments was made to determine the effect of air and feed rates on the pressure drop obtained with different materials. Air velocities from 40 to 90 ft./sec. were used with solid feed rates between three and 20 lb./min.; the feed rate was controlled by the size of the aperture leading to the entry port.

In the first the pressures in the system were measured for various rates of flow of air alone. In subsequent tests solid was introduced into the air stream and the following procedure was adopted: The feed hopper was closed by the blocking cone, and a quantity of material, suitable for a run of approximately 90 seconds, was introduced through the top inlet, which was then sealed by means of a screw cap. The air rate was adjusted and the experiment was started by raising the blocking cone.

Pressure drop under transport conditions generally became steady after 20 to 25 seconds. After 45 seconds, approximately halfway through the experiment, readings of air rate, total pressures at the orifice and at the measuring sections and pressure drops over all relevant sections were taken. The end of the run was indicated very clearly by a sudden change of pressure drop in the feed section. The run was timed and the material which had collected in the cyclone separator was weighed, in order to calculate the feed rate.

In the early experiments pressure drops were measured over all sections of the plant, including the bends, but in the later work pressures were measured only over the last two sections of the third line.

For the experiments in solid velocity measurements one section of pipe in the third line was replaced by an isolator.

Air Velocities

Cress and brass were conveyed at a limited number of feed rates at air velocities of 45, 60, 75 and 90 ft./sec., the runs being conducted as previously described. After 30 seconds all the necessary readings of pressure drop were taken and, after 60 seconds, the isolator was operated and the compressor was switched off immediately.

Weight of material collected in the isolator was measured; sufficient experiments were carried out to obtain an average weight with a 95 per cent probability of being within ± 5 per cent of the true mean. As a safeguard against the possibility of a constant time interval between the operation

of the two shutters, all sets of measurements were carried out with the isolator in both the forward and reversed positions. The solid velocity was then calculated.

In the work with brass, it was necessary to introduce a felt lining in the housing of the shutters to prevent fine powder from entering the gland and impeding the movements of the spindle.

A set of runs carried out with cress when using the felt lining indicated that the results obtained were independent of the presence of the felt. It was also shown that variations of the springs operating the shutters did not affect the results.

For cress the velocity of the solid relative to the air appears to be constant and independent of air velocity within the range investigated. In the case of brass, the relative velocity increases with increasing air velocity.

Insufficient experiments have been carried out for a complete correlation of the pressure drop for all materials. However, separate empirical correlations, covering the complete range of feed rates employed, have been obtained in terms of the total pressure drop in the pipe, under conditions where the particles are fully accelerated, for cress and brass.

It has been observed that with some materials, including sands, granite dust and carborundum, the pressure drop during the conveying shows a drift with time.

Thus, if a particular sample of sand was conveyed in the plant for a long period, the excess pressure drop due to the solid was found to increase with time and eventually to reach a steady value, which sometimes was as much as 10 times that obtained in the initial runs.

If a fresh batch of the same solid was then introduced into the system, a pressure drop intermediate between the initial and the final values given by the original sample was obtained. This suggests that the plant and, to a lesser extent, the material was affected.

No Satisfactory Explanation

No entirely satisfactory explanation of this phenomenon has yet been put forward, but electrostatic charges have been detected on the sight glass and the material. This effect was not appreciable with the five materials discussed in this paper.

The authors acknowledged the assistance of Mr. L. Mitlin, who has participated in the work during the past year, and who is continuing with the investigation.

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Higher Tariffs Sought

AN appeal to the Federal Government to protect Canada's fast growing chemical industry and save it from increasing foreign competition by building a higher tariff wall, was made by Dr. R. S. Jane, president of the Chemical Institute of Canada in a recent speech to the Ottawa section.

Higher tariffs, said Dr. Jane, need not mean that the consumer would be penalised with higher prices. An agreement could be worked out between the Government and any chemical company which would supply the tariff-protected item to Canadian consumers at equivalent world prices. If the company failed to live up to the agreement, then the tariff would be removed and the foreign product allowed to enter free of duty.

Trade in chemicals with the U.S.A. had become 'pretty much a one way street,' because Canada with little or no tariff wall was in a poor bargaining position.

U.S. Technical Bibliography

Valuable technical advances for the chemical and metallurgical industries are described in the current issue of the Bibliography of Technical Reports, available from the Office of Technical Services of the U.S. Department of Commerce, Washington 25, D.C. In all, 278 reports are listed from the laboratories of the Federal Government, from industrial and university laboratories working for it, and from foreign government and other non-confidential sources.

Tannery Effluent Disposal

Views Expressed at Manchester Meeting

PROBLEMS in the disposal of tannery effluent were the subject of some interesting papers and lively discussion at a meeting of the Manchester Group of the Society of Leather Trades' Chemists, held at the Engineers' Club, Manchester, on 11 October.

The point of view of the River Board was outlined by M. Lovett, B.Sc., F.R.I.C., F.Inst.S.P. (Chief Inspector, Yorkshire Ouse River Board), who gave extracts from the Prevention of Pollution Act and stated the number of parts per million of suspended solids in effluent acceptable by Rivers Boards. The object of the Act was to 'maintain and restore the wholesomeness of rivers.' Discharge of good lime-liquor into rivers was objectionable and the discharge of sodium sulphide could remove all the oxygen from the water.

Mr. J. Crosby Veale, discussed the problem from the tanners' viewpoint and described many types of installations which could be used for the removal of suspended matter from tannery effluent as a primary treatment. The recovery of material by rotating brushes, types of tanks with weir flow to lessen velocity, filter beds, ponds, soak-aways, and a vacuum drum, were mentioned to illustrate that settling of effluent should not be considered as a simple matter. Mr. Veale was of the opinion that some of the tanners' effluent problems were insoluble and that it was almost impossible to comply with the proposals of the Royal Commission.

Methods Described

Methods of dealing with effluent at a sewage works were described by Mr. F. W. Allen, A.R.I.C., F.Inst.S.P. (manager, Bolton Sewage Works), who illustrated his talk with a film. Mr. Allen's views on the effects of tannery effluent on sewage treatment were somewhat pointed, but at a later stage in the proceedings he received some information on tannery effluent from his audience for which he expressed his thanks. The parts per million of suspended solids in effluent discharged to a sewage works was given and the rotation in dealing with sludge on a sewage farm was described. Further disposal of sludge was effected by drying and then selling as fertiliser.

In the combined discussion on the papers which followed it was explained that the discharge of effluent into the tidal part of a river could still cause pollution. There was a difference of opinion about at what stage tanyard effluent and limeyard effluent should be run together in order to accomplish maximum precipitation and also on the *p*H at which maximum precipitations would occur. It was suggested that different conditions might require alterations in control.

Science Aids Railways

ADEQUATE protection against weather for goods being transported by trucks is one of the many problems which have to be considered by British Railways.

Wagon sheets up to now have been made of canvas dressed with a compound of linseed oil and bauxite. The sheets have good water-proof properties, but are heavy and cumbersome to handle and tend to become sticky in use; they are also expensive to repair.

The problem has been under study for some time by the railways, and substantial progress has already been made on cartage sheets. A new type of sheet, made from 19/20 oz. canvas with a chemical emulsion proofing, has been adopted as standard for the bulk of railway cartage requirements.

At the invitation of the Railway Executive, leading experts from scientific organisations, trading associations and important industrial undertakings have promised their co-operation in studying the problem and a special technical committee has been set up under the chairmanship of Mr. F. Fancutt, F.R.I.C., A.M.I.Chem.E., superintendent, chemistry division, Directorate of Research of the Railway Executive.

Other members of the committee include: Mr. J. Pollitt, British Cotton Industry Research Association; Dr. A. J. Turner, director research, Linen Industry Research Association; and Mr. W. Baker, leathercloth division, Imperial Chemical Industries, Ltd.

At the first meeting of the committee held in London recently, Mr. A. Forbes Smith (chief officer (Stores), Railway Executive) said that the Executive warmly welcomed the co-operation which was so readily given by the interests represented. The matter was not an easy one, because of the exacting conditions of railway traffic.

The Spanish Chemical Industry

Progress Towards Self-Sufficiency

AN interesting discussion of some of the major problems affecting the Spanish chemical and allied industries is given in an editorial in *Chemische Industrie* (1952, **4** (9), 606-8) the writer of which has just returned from a tour in that country. While Spain is admittedly not lacking in some kinds of raw material there are certainly some important gaps, especially in the matter of fuel. Nevertheless, strenuous attempts have been and are being made to become self-supporting in as many industrial fields as possible. This is stimulated by the special circumstances imposed by two world wars and subsequent boycott by the allies.

It seems likely, at least for some time to come until mineral prospecting is better organised and more efficient, that Spain's chief source of wealth will be agriculture and forestry. Special attention was given by the Government to afforestation, and at the beginning of the last war several schools of forestry were established, especially to increase or restore fertility on the central plateaus. These schools supply yearly over 400,000,000 trees. Since 1940 some 800,000 acres or more have been re-afforested, especially with eucalyptus, with consequent extension of cornfields and vineyards. Waste products from the latter, and of course the trees themselves, are contributing largely to the national supplies of cellulose on an increasing scale year by year. Stock farming, too, has been extended in this way.

Task of Expansion

For industry generally the Instituto Nacional de Industria, established on 25 September, 1941, has been charged with the task of expansion, more particularly in the chemical field and, among other things, of co-ordinating and extending research in collaboration with other state or private enterprises (Empresas and Sociedads). Those connected with mineral exploration, metallurgy, nitrogen products, fuels and lubricants, and so on, are likely to come under the notice of the Institute. Nevertheless there is still much dependence on foreign research, foreign books and chemical periodicals; also licences under foreign patents, and in some cases foreign research workers and engineers.

At the same time it is a little remarkable, in some cases, to what a high degree Spanish research has sought and found its own independent paths. For example, one of the research institutes in Madrid (director Eduardo Angulo) of the well-known Empresa Nacional Calvo Sotelo, has developed a low temperature distillation method for the oil shales found and worked on a large scale at Puertollano, and a lignite distillation process and plant, also on a considerable scale, at Puentes de Garcia Rodriguez.

Uses For Waste Products

At present the Institute is working, among other things, on the development of methods for making use of the waste products of the olive, grape, orange and other fruit processing industries, available in enormous quantities, as well as maize, cotton and other crop wastes. It is already claimed in this chemurgical field, that many useful products, including fuels, have been evolved.

On the subject of academic studies, training of chemists, and facilities for advanced research, the country is rather behind in these matters. Many of the Spanish directors, chief chemists and engineers have been trained in Germany, the U.S.A. or England, and it appears that this must be the case for some time to come. At the same time the Government is alive to the need for improving home facilities in this direction, and through the universities and existing and proposed new institutes, it is hoped to provide the young chemist and engineer with better opportunities for study and practical experience. A striking example of this is the new University of Madrid, built in accordance with the most modern ideas, to be a centre of study and culture for all Spanish speaking people. But there is also a serious lack of trained chemical workers, process operatives and engineers, for whom technical schools and colleges are needed.

It so happens that, despite the desire for all-Spanish enterprise, there is still a large group of chemical works that are branches of or related in some way to foreign companies, with a considerable percentage of foreign workers of all grades on the payroll. A second group comprises purely Spanish

undertakings. Generally, the Government is endeavouring to foster native machine and chemical apparatus industries by means of high protective tariffs or in other ways, so that the cost of such apparatus is relatively high, and in many cases the quality inferior to that of foreign products.

Another difficulty is an adequate supply of fuel and water. Many Spanish chemical works, even relatively small ones, have found it the best policy to provide their own power plants, in many cases using water-power. Examples are to be found in the Electroquimica de Hernani, near San Sebastian, which has one of the most modern salt electrolysis plants in Spain, with PVC as by-product. The Empresa Nacional Calvo Sotelo de Combustibles y Lubricantes, Escatron, has a lignite-fired power plant.

It is being increasingly realised that amalgamation of several small concerns into larger units is often the best policy, which is indeed encouraged and financially aided by the Government.

Supplementary Sulphur

A SUPPLEMENTARY distribution of crude sulphur for the last six months of 1952 was announced by the Sulphur Committee of the International Materials Conference on 21 October.

The plan of distribution announced on 18 July was stated to be for the whole of the last six months, on the understanding that the committee might review the allocation for the last quarter. While it has not been found necessary to carry out a general review of the allocation for the fourth quarter, increased exports, mainly from Latin America, have become available.

Provision was made in the original allocation for a quantity to be set aside as a contingency reserve, the balance of which is now being distributed. After reviewing these factors, the committee has recommended a supplementary distribution for the last six months of 1952 of 29,800 long tons.

Requests have been received from member and non-member importing Governments for increased import quotas and, in the light of these, the committee has agreed that the import quotas of the importing countries named below should be increased by the amounts set out as follows: Argentina, 6,500 tons; Australia, 3,500 tons; Brazil, 6,800 tons; Finland, 1,300 tons; France, 4,300 tons; India, 3,000 tons; New Zealand, 800 tons; Philippines, 3,000 tons; Uruguay, 600 tons.

The above allocation takes into account the additional export quotas of Chile, Norway, and Mtxico amounting to 16,500, 3,900, and 700 long tons respectively.

New Session Opens

THE first meeting of the new session of the North-Western Branch of the Institution of Chemical Engineers was held at Manchester on 18 October, when the president of the Institution, Mr. S. Robson, M.Sc., D.I.C., presented an address on 'The Further Training of the Chemical Engineer.'

Mr. Robson stressed the importance of the education and of the training of the chemical engineer after graduation and drew attention to the O.E.E.C. report on chemical apparatus in the U.S.A. The early literature on chemical engineering included the reports of the Ministry of Munitions published after World War 1 in addition to Geo. E. Davis's handbook. Education in chemical engineering in the U.K. with its emphasis on basic problems is good but we train relatively few. The further education of the chemical engineer in a large works depends on the systems adopted by companies. Practical experience is needed to supplement book-learning and is gained on the process plants, in the research laboratories and in the workshops on maintenance work. In small works, a wider experience is obtained on actual plants which should be studied quantitatively. Data on plants should be made available as soon as adequate reward for efforts have been reaped and much information from other companies is received as a result of such publication.

Appeal Progressing

H.R.H. THE DUKE OF EDINBURGH attended the dinner held at University College, London, on 15 October to celebrate the centenary of the birth of Sir William Ramsay. It was announced by DR. B. IFOR EVANS, provost of University College, that nearly £57,000 had already been promised in response to the appeal for £100,000 to restore to full strength the number of English Ramsay Memoral Fellowships and to build additional laboratories. The appeal had been addressed to industry.

New Technical College

Ministry Assumes Responsibility

As a result of representations from the Leicestershire local education authority, the Minister of Education has decided to relieve the authority of responsibility for maintaining the Engineering and Science Departments of Loughborough College and to organise them as a separate establishment maintained principally by grant from the Exchequer.

Loughborough College is widely known for the training of engineers, and its students are drawn from all parts of the United Kingdom and from abroad. The cost of tuition and residence has, however, risen rapidly during the past few years, and the local education authority has found that the increasing burden on the Leicestershire ratepayers could no longer be justified in view of the small number of Leicestershire students in attendance—about 50 out of a total of over 800.

Annual Grant

In view of the exceptional circumstances, the Minister acceded to the request, the local education authority agreeing to make an annual grant of £15,000 a year towards the cost of the college.

The new college will be known as the Institute of Technology, Loughborough. A governing body has been set up by the Minister with Sir Harold West (managing director of Newton Chambers & Co., Ltd., Sheffield) as chairman. Among the members of the governing body are Professor E. H. Garner, nominated by the Institution of Chemical Engineers, and Mr. H. W. Cremer, nominated by the Minister of Education.

Arrrangements have been made by the local education authority to transfer to the Governors the buildings and equipment used by the Science and Engineering Departments together with a large new building in the course of construction, and a number of hostels. The teaching and other staff have also transferred to the service of the new governing body, which became responsible for the Institute of Technology from 1 September, 1952.

The new institute is well equipped to teach all branches of engineering including civil, chemical, mechanical, electrical and aeronautical, and will continue to specialise on these lines. Facilities will be further improved when the new block (devoted chiefly to engineering laboratories) comes into use in about a year's time.

Beilby Memorial Award

1952 Choice to be Decided

From the interest derived from the invested capital of the Sir George Beilby Memorial Fund, at intervals to be determined by the administrators representing the Royal Institute of Chemistry, the Society of Chemical Industry and the Institute of Metals, awards are made to British investigators in science, to mark appreciation of records of distinguished work. Preference is given to investigations relating to the special interests of Sir George Beilby, including problems connected with fuel economy, chemical engineering and metallurgy, and awards are made, not on the result of any competition, but in recognition of continuous work of exceptional merit, bearing evidence of distinct advancement in science and practice.

In general, awards are not applicable to workers of established repute, but are granted as an encouragement to younger men who have done original independent work of exceptional merit over a period of years.

The administrators are empowered to make more than one award in a given year if work of sufficient merit by several candidates is brought to their notice. For 1951 two awards, each of one hundred guineas, were made to Dr. K. H. Jack and Dr. W. A. Wood.

Consideration will be given to the making of an award or awards from the Fund early in 1953. Outstanding work of the nature indicated may be brought to the notice of the Administrators, either by persons who desire to recommend the candidate or by the candidate himself, *not later than* 31 *December*, 1952, by letter addressed to the Convenor of the Administrators, Sir George Beilby Memorial Fund, Royal Institute of Chemistry, 30 Russell Square, London, W.C.1.

The letter should be accompanied by a short statement on the candidate's career (date of birth; education and experience, degrees and other qualifications, special awards, etc., with dates) and by eight copies of a list of references to papers or other works published by the candidate.

· HOME ·

Zinc Price Reduced

The price of U.K. zinc has been cut by £4 to £118 a ton delivered consumers' works as from 9 October. Premiums for higher grades remain unchanged. This is the lowest level this year.

Busy Billingham

According to the October issue of *The Tees-side Journal of Commerce,* as many as 27 inward and 25 outward trains daily go over the 75 miles of track at Imperial Chemical Industries' factory at Billingham. It is well known that Billingham is the largest chemical works in the British Commonwealth but it is probable that few people fully realise its great size or tremendous output.

Project Dropped

The Wakefield branch of the National Farmers' Union was informed on 16 October that Imperial Chemical Industries Limited had decided not to proceed with its scheme to buy 1,000 acres of land near Knottingley, on which to erect a mines explosive factory and had consequently ceased to negotiate with farmers for the sale of the land. The question had been raised whether a farmer who had altered the layout of his holding in order that 200 acres might be sold was entitled to compensation, in view of the fact that there had been a lapse of 12 months between the announcement of the project and the decision to discontinue. Counsel's opinion was said to be that a good case could be made out.

Appeal Dismissed

An appeal by Imperial Chemical Industries Ltd., against an interim injunction granted by Mr. Justice Upjohn to British Nylon Spinners, Ltd., restraining I.C.I. from assigning a number of nylon patents (THE CHEMICAL AGE, **67**, 276), was dismissed by the Court of Appeal on 16 October. The Master of the Rolls giving judgment said that the order of the American courts was an assertion of extraterritorial rights because it would affect or destroy the rights of a British National not subject to its jurisdiction. Dismissal of the appeal, said the judge, did not prejudice the right of I.C.I. to apply for the discharge of the injunction in whole or in part should the circumstances arise.

Tungsten Buying Price Reduced

A reduction of 15s. in the buying price of Wolfram ore to 410s. a long ton unit c.i.f. United Kingdom was announced by the Ministry of Materials on 20 October. This increased the margin of the Ministry by 37s. 6d., the selling price remaining unaltered at 447s. 6d.

Chemicals & Overseas Trade

Exports of chemicals, drugs, dyes and colours in September valued at £10,616.689 showed little change from the two previous months, but were £648,846 less than in September, 1951. The total value of exports for the first nine months of this year at £106,798,056 is over £2,000,000 more than the same period of 1951.

Technicians for Oil Refinery

Some 150 technicians and workers, an advance party of a labour force which will build a new oil refinery at Aden for the Iraq Petroleum Company, sailed from Birkenhead on 21 October. The main body of workers is expected to follow early in the New Year. A total of 20,000 workers, including native labour, will be employed on the project which is expected to take about two years to complete.

Success Rewarded

Cash awards for success in examinations under its education scheme have been made by Dunlop, as follows: £10 to R. Jones, technical department, Dunlop Special Products, Ltd. (final examination, City and Guilds of London Institute, Technology of Plastics); S. W. Brigstock, Chemical Research, Fort Dunlop (Associateship, Royal Institute of Chemistry). £7 10s. to J. B. Smith, technical department, Dunlop Special Products, Ltd. (intermediate examination, City and Guilds of London Institute, Technology of Plastics).

Chemists' Golf

Despite adverse weather some 20 competitors enjoyed a good day's golf in the second annual competition of the Society of Cosmetic Chemists held at Walton Heath, Surrey, on 1 October. The competition for the Firmerich Cups was won by Mr. M. F. London with a nett score of 75.

· OVERSEAS ·

French Pyrites Production

World-wide shortage of sulphur during 1951 caused most countries to try and increase their own production. In France, output of pyrites with a 42 per cent sulphur content rose in 1951 by 35,000 to 280,000 tons. In addition, imports of pyrites (45 per cent grade), increased from 570,000 tons in 1950 to 704,000 tons in 1951, the main sources being Cyprus, Portugal and Spain.

Loan Sought for New Equipment

In order to expand its production of potassium nitrate the Anglo-Lautaro Nitrate Company is said to be seeking from the Export-Import Bank a loan of U.S. $5,000,000, to be used for the purchase of machinery and equipment.

Oil Prospecting in Israel

There are four groups who are taking a very active part in prospecting for oil in Israel, namely, the Federman-Swiss group, Ampal-Mekoroth, the New Continental Oil Company of Canada and a group headed by a Mr. Kapnik, of South Africa. It is learned that the New Continental Company of Canada was the first to apply for a permit in order to carry out the preliminary oil prospecting.

South African Uranium

The first extraction plant at West Consolidated Mine, Krugersdorp, costing £1,600,000, has been opened by the Prime Minister, who stated that the bulk of the Union's production of uranium oxide will be exported, but that it is intended to keep some for atomic research and industrial purposes. The Minister stated that South African uranium contracts are so valuable that, when fully developed, uranium will ultimately become as valuable to the country as gold, and the life of many gold mines will be lengthened as a result.

Argentinian Oil Well

Argentine State Oilfields has announced the drilling of a new well in the Campo Duran oilfield, in the Province of Salta, to a depth of 3½ kilometres. It now has a daily output of 250,000 litres of petroleum and 750,000 cu. metres of gas; these together have a calorific value equivalent to 1,000 tons of fuel oil.

British Guiana Source of Columbite

A columbite producing unit has arrived in British Guiana and operations have started expecting to treat between 350 to 400 cu. yds. of gravel per day. Laboratory tests of columbite in British Guiana have indicated that its quality compares favourably with that of similar ore found in other parts of the world.

Brazil Extracts Liquid Fuel

The Brazilian Government is reported to be negotiating with a U.S. company for the installation of equipment for the extraction of liquid fuel from bituminous schist in the State of Sao Paulo, at an estimated cost of U.S. $35,000,000.

Venezuelan Natural Gas

A plant for supplying natural gas for industrial purposes was recently opened in Valencia by the Venezuelan Atlantic Refining Incorporated, which has installed a 300-kilometre gas pipeline. The local cement factory was the first to make use of the natural gas for power in this rapidly developing industrial town.

New Organisation

The president of the Mathieson Chemical Corporation, of Baltimore, U.S.A., has announced that the operations, sales and development activities of the Corporation have now been placed in four major divisions. These will be known as: Mathieson Development Company, Mathieson Industrial Chemicals Company, Mathieson Agricultural Chemicals Company, and E. R. Squibb & Sons.

Oil Refinery in Bombay

The Standard-Vacuum Oil Company announced in Bombay recently that the contract for constructing the company's 25,000-barrel-per-day crude oil refinery in Bombay has been given to the Lummus Company, an American firm which has constructed in the last 60 years approximately 250 petroleum refining units and more than 300 chemical processing units in many parts of the world including India. The head engineer in the Lummus co-ordinating department, has already arrived in Bombay. The $35,000,000 refinery project is expected to be completed by the end of 1954.

· PERSONAL ·

MR. J. D. NUTTAL, Secretary of the Triplex Safety Glass Co., Ltd., has been appointed to the Board of Quickfit & Quartz, Ltd., manufacturers of scientific and industrial glassware, of Stone (Staffs). Mr. Nuttal joined the Triplex group in January 1946. He was appointed secretary on 1 January, 1948, on which date he was also made secretary of Quickfit and Quartz, Ltd.

DR. NORMAN EVERS, director of research at Allen & Hanbury's, Ltd., was recently presented by the directors at a cocktail party in the Abercorn Rooms, London, with a television set on his retirement after 40 years' service. Dr. Evers joined Allen & Hanbury's from the laboratory of Birmingham City Analyst. He was closely associated in 1922 with the pioneer work in connection with the first production of insulin in this country. In 1948 and 1949 he was chairman of the British Pharmaceutical Conference.

Dr. Norman Evers is seen here with the chairman, Mr. F. C. Hanbury, left, and the vice-chairman, Mr. J. C. Hanbury, right

The appointment of MR. S. A. CLARKE to the board of directors has been announced by Gent & Co., Ltd., electrical engineers. Mr. Clarke has been with the company since 1910 and is now progress manager.

MR. ADAM DUNLOP has resigned from Messrs. Rolls-Royce, Ltd., on his appointment as technical director of Messrs. Shaw Processes, Ltd., consultants.

The following officers have been elected to the council of the Institute of Metals with effect from the 1953 annual general meeting: *President*: PROFESSOR F. C. THOMPSON (Professor of Metallurgy, University of Manchester); *Vice-presidents*: MAJOR C. J. P. BALL (chairman, Magnesium Elektron, Ltd.), and PROFESSOR G. V. RAYNOR (Professor of Metal Physics, University of Birmingham); *Members*: MR. W. A. BAKER (research manager, British Non-Ferrous Metals Research Association); MR. J. C. COLQUHOUN (chairman and managing director, The Manganese Bronze & Brass Co., Ltd.); MR. E. R. GADD (chief metallurgist, Engine Division, The Bristol Aeroplane Co., Ltd.), and THE HON. JOHN GRIMSTON, M.P. (director and general manager, Enfield Rolling Mills, Ltd.) The council has elected DR. S. F. DOREY (chief engineer surveyor, Lloyd's Register of Shipping) to serve as senior vice-president for 1953-54.

MR. HAROLD OCTAVIUS SMITH, of Mattingley Lodge, near Basingstoke, and formerly of Treliske, Truro, a director of Imperial Chemical Industries, Ltd., 1936-51, Director-General of Ammunition Production during the last war, and formerly chairman of I.C.I. Metals, Ltd., Witton, who died on 17 May last, aged 69, left £54,848 gross (£48,548 net).

Obituary

The Council of the Institution of Chemical Engineers have regretfully announced the sudden death of their honorary secretary, MR. L. O. NEWTON, on 2 October, at the age of 70 years. Mr. Newton had been a member of the Institution since 1928; he was a vice-president in 1938-39 and was appointed chairman of the Nomination Committee in 1940 and served in that capacity for 12 years. He was elected joint hon. secretary in 1945 and retained this office until 1949 when he became sole hon. secretary. Mr. Newton was managing director of Sofnol, Ltd., and a consulting chemical engineer.

PROFESSOR M. B. DONALD has accepted the Council's invitation to become hon. secretary of the Institution.

British Chemical Prices

LONDON.—The volume of new business on the industrial chemicals market has not been substantial, but a steady flow of inquiry continues to be reported both from home and overseas buyers.

Quotations for lead compounds continue to fall and a further reduction in the value of zinc brought lower prices for the oxides, which have been reduced by £6 a ton. Elsewhere prices remain steady at recent levels with the exception of home-produced cream of tartar which has fallen by 10s. a ton.

Conditions in the coal tar products market are quiet and no outstanding feature is reported. Pitch, creosote oil and cresylic acid are in fairly good demand.

MANCHESTER.—Apart from a rather sharp decline in sulphate of copper and further easiness in the lead compounds, prices on the Manchester chemical market during the past week have shown little change. The demand for a fairly wide range of products for the textile and allied industries continues to show a slight recovery and a reasonably steady call for contract deliveries from most of the other leading outlets for chemicals is reported. The movement of supplies on export account has been about maintained at the level of recent weeks. The demand for the tar products is rather patchy, but in most sections fair quantities are being called for.

GLASGOW.—Manufacturers and merchants report a good week's trading covering a wide range of chemical products, and from the inquiries on hand prospects for the immediate future appear to be good. As opposed to home demands, the export market during the past week has been rather quiet.

General Chemicals

Acetic Acid.—Per ton : 80% technical, 1 ton, £107 ; 80% pure, 1 ton, £112 ; commercial glacial 1 ton, £118 ; delivered buyers' premises in returnable barrels ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £149 per ton.

Acetone.—Small lots : 5 gal. drums, £145 per ton ; 10 gal. drums, £135 per ton. In 40/50 gal. drums less than 1 ton, £115 per ton ; 1 to 9 tons, £114 per ton ; 10 to 49 tons, to £113 per ton ; 50 tons and over, £112 per ton.

Alcohol, Industrial Absolute.—300,000 gal. lots. d/d, 3s. 7½d. per proof gallon ; 100,000 and less than 200,000 gal. lots, d/d, 3s. 8½d. per proof gal.

Alcohol, Diacetone.—Small lots : 5 gal. drums, £204 per ton ; 10 gal. drums, £194 per ton. In 40/45 gal. drums : less than 1 ton, £174 per ton ; 1 to 9 tons, £173 per ton ; 10 to 50 tons, £172 per ton ; 50 to 100 tons, £171 per ton ; 100 tons and over, £170 per ton.

Allyl Alcohol.—Less than 40 gals., 3s. 10½d. per lb. ; 40 gal., 3s. 6½d. per lb. ; 2 to 5 40 gal. drums, 3s. 4½d. per lb. ; 1 ton and over, 3s. 2½d. per lb.

Alum.—Loose lump, £18 per ton, f.o.r. MANCHESTER : Ground, £17 10s.

Aluminium Sulphate.—Ex works, £12 per ton d/d. MANCHESTER : £11 10s. to £12.

Ammonia. Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—2 cwt. non-returnable drums ; 1 ton lots £47 per ton.

Ammonium Chloride. — Grey galvanising, £31 5s. per ton, in casks, ex wharf. Fine white 98%, £23 12s. 6d. to £26 5s. per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate. — MANCHESTER : £6 2s. 6d. per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £93 and £91 10s. per ton.

Antimony Sulphide.—Golden, d/d in 5 cwt. lots as to grade, etc., 2s. 3½d. to 3s. 1½d. per lb. Crimson, 3s. 4½d. to 4s. 5½d. per lb.

Arsenic.—Per ton, £59 5s. nominal, ex store.

Barium Carbonate.—Precip., d/d ; 2-ton lots, £35 5s. per ton, bag packing.

Barium Chloride.—£44 10s. 2 ton lots d/d bags.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £41 per ton d/d ; 2-ton lots, £41 5s. per ton d/d.

Bleaching Powder.—£21 per ton in casks (1 ton lots).

Borax.—Per ton for ton lots, in free 140-lb. bags, carriage paid: Anhydrous, £59 10s. ; in 1-cwt. bags; commercial, granular, £39 10s. ; crystal, £42 ; powder, £43 ; extra fine powder, £44 ; B.P., granular, £48 10s. ; crystal, £51 ; powder, £52 ; extra fine powder £53.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid : Commercial, granular, £68 ; crystal, £76 ; powder, £73 10s. ; extra fine powder, £75 10s. ; B.P., granular, £81 ; crystal, £88 ; powder, £85 10s. ; extra fine powder, £87 10s.

Butyl Acetate BSS.—£202 per ton, in 10-ton lots.

Butyl Alcohol BSS.—£180 per ton, in 10-ton lots.

***sec.*-Butyl Alcohol.**—5 gal. drums £164 ; 40/45 gal drums : less than 1 ton £144 per ton ; 1 to 10 tons £143 per ton ; 100 tons and over £140 per ton.

***tert.*-Butyl Alcohol.**—5 gal. drums £195 10s. per ton ; 40/45 gal. drums : less than 1 ton £175 10s. per ton ; 1 to 5 tons £174 10s. per ton ; 5 to 10 tons, £173 10s. ; 10 tons and over £172 10s.

Calcium Chloride.—70/72% solid £9 12s. 6d. per ton, in 4-ton lots.

Chlorine, Liquid.—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

Chromic Acid.—2s. 0¼d. to 2s. 0¾d. per lb., less 2½%, d/d U.K.

Citric Acid.—1 cwt. lots, 213s. cwt. 5 cwt. lots, 208s. cwt.

Cobalt Oxide.—Black, delivered, 13s. per lb.

Copper Carbonate.—MANCHESTER : 2s. 8d. per lb.

Copper Sulphate.—£97 10s. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £11 2s. d/d.

Ethyl Acetate.—10 tons and upwards, d/d, £164 per ton.

Formaldehyde.—£35 10s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £82 5s. in 4-ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1.260 S.G. £14 19s. per cwt.
Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hydrochloric Acid.—Spot, 12s. to 16s. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—27.5% wt. £124 10s. per ton. 35% wt. £153 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed B.P., 21s. 3d. per lb. in cwt. lots.

Iodoform.—25s. 4d. per lb. in cwt. lots.

Lactic Acid.—Pale tech., 44 per cent by weight £122 per ton ; dark tech., 44 per cent by weight £65 per ton ex works ; Usual container terms.

Lead Acetate.—White : £162 10s. per ton.

Lead Nitrate.—£119 per ton.

Lead, Red.—Basis prices per ton : Genuine dry red lead, £119 15s. ; orange lead, £131 15s. Ground in oil : red, £147 10s., orange, £159 10s.

Lead, White.—Basis prices : Dry English, in 5-cwt. casks, £135 15s. per ton. Ground in oil : English, under 2 tons, £158 5s.

Lime Acetate.—Brown, ton lots, d/d, £30 to £34 per ton ; grey, 80-82%, ton lots, d/d, £34 to £39 per ton.

Litharge.—£119 5s. per ton.

Magnesite.—Calcined, in bags, ex works, £22 to £24.

Magnesium Carbonate.—Light, commercial, d/d, £87 15s. ; cwt. lots £97 10s. per ton d/d.

Magnesium Chloride.—Solid (ex wharf), £15 per ton.

Magnesium Oxide.—Light, commercial, d/d, £221 ; cwt. lots £227 10s. per ton d/d.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—19s. 3d. per lb. in 28 lb. lots ; smaller quantities dearer.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 6s. 4½d. per gal. ; pyridinised 64° O.P. 100 gal., 6s. 6d. per gal.

Methyl Ethyl Ketone.—5 gal. drums, £173 per ton ; in 40-45 gal. drums, less than 1 ton, £153 per ton ; 50 to 100 tons, £150 per ton ; 100 tons and over, £149 per ton.

Methyl *iso*Butyl Ketone.—5 gal. drums, £203 per ton ; in 40-45 gal. drums, less than 1 ton, £183 per ton ; 50 to 100 tons, £180 per ton ; 100 tons and over, £179 per ton.

Nickel Sulphate.—D/d. buyers U.K. £140 10s. per ton.

Nitric Acid.—£35 to £40 per ton, ex works.

Oxalic Acid.—About £181 per ton, packed in 5-cwt. lots, packed in free 5-cwt. casks.

Phosphoric Acid.—Technical (S.G. 1.700) ton lots, carriage paid, £87 per ton ; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 3½d. per lb.

Potash, Caustic.—Solid, £98 10s. per ton for 1-ton lots ; Liquid, £37 15s.

Potassium Bichromate.—Crystals and granular, 11⅝d. per lb. ; ground, 1s. 0⅝d. per lb., standard quantities.

Potassium Carbonate.—Calcined, 98/100%, £116 per ton for 1-ton lots, ex store.

Potassium Chloride.—Industrial, 96%, 6-ton lots, £20 to £22 per ton.

Potassium Iodide.—B.P., 18s. 7d. per lb. in 28 lb. lots ; 18s. 1d. in cwt. lots.

Potassium Nitrate.—Small granular crystals, 81s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 9½d. per lb. for 1-cwt. lots ; for 3 cwt. and upwards, 1s. 8½d. per lb. ; technical, £9 2s. per cwt. ; for 5 cwt. lots.

***iso*Propyl Alcohol.**—Small lots : 5 gal. drums, £156 per ton ; 10 gal. drums, £146 per ton ; in 40-45 gal. drums : less than 1 ton, £126 per ton ; 1 to 9 tons, £125 per ton ; 10 to 50 tons, £124 per ton ; 50 to 100 tons, £123 per ton ; 100 tons and over, £122 per ton.

Salammoniac.—Dog-tooth crystals, £72 10s. per ton ; medium, £67 10s. per ton ; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

Salicylic Acid. — MANCHESTER : Technical 2s. 7d. per lb. d/d.

Soda Ash.—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

Soda, Caustic.—Solid 76/77% ; spot, £23 5s. per ton d/d. (4 ton lots).

Sodium Acetate.—£85 to £91 per ton d/d.

Sodium Bicarbonate.—Refined, spot. £12 7s. 6d. per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 9¾d. per lb. ; anhydrous, 11¾d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite.—Powder, 60/62%, £40 per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

Sodium Chlorate.—£87 to £95 per ton.

Sodium Cyanide.—100% basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite.—Pea crystals £28 a ton ; commercial, 1-ton lots, £26 per ton carriage paid.

Sodium Iodide.—B.P., 20s. 1d. per lb. in 28 lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £123 ton.

Sodium Metasilicate.—£22 15s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial, 97-98%, 6-ton lots, d/d station, £28 10s. per ton.

Sodium Nitrite.—£31 for 1 ton lots.

Sodium Percarbonate.—12½% available oxygen, £8 8s. 4½d. per cwt. in 1-cwt. drums.

Sodium Phosphate.—Per ton d/d for ton lots : Di-sodium, crystalline, £37 10s., anhydrous, £78 10s. ; tri-sodium, crystalline, £39 10s., anhydrous, £75 10s.

Sodium Prussiate.—10d. to 10½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber's Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER : £6 10s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot. £30 per ton, d/d, in drums ; broken, £30 15s. per ton, d/d, in drums.

Sodium Sulphite.—Anhydrous, £59 per ton ; pea crystals, £37 12s. 6d. per ton d/d station in kegs ; commercial, £23 7s. 6d. per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £22 16s. 6d. to £25 6s. according to fineness.

Tartaric Acid.—Per cwt.: 10 cwt. or more, £12 5s.

Titanium Oxide.—Standard grade comm., with rutile structure £143 per ton; standard grade comm., £130 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d; white seal, £144 10s.; green seal, £143 10s.; red seal, £142.

Rubber Chemicals

Antimony Sulphide.—Golden, 2s. 3¼d. to 3s. 1½d. per lb. Crimson, 3s. 4¼d. to 4s. 5¼d. per lb.

Carbon Bisulphide.—£65 5s. per ton, according to quality.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£74 10s. per ton.

India-rubber Substitutes.—White, 1s. 8¾d. to 2s. 0¾d. per lb.; dark, 1s. 6½d. to 1s. 11d. per lb.

Lithopone.—30%, £60 per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, 'Rupron.'—£20 per ton.

Sulphur Chloride.—British 48s. 6d. per cwt.; Imported £120 per ton.

Vegetable Lamp Black.—£49 per ton

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £16 18s.

Compound Fertilisers.—Per ton in 6 ton lots, d/d farmer's nearest station, I.C.I. Special No. 1 £27 9s.

'Nitro-Chalk.'—£12 9s. 6d. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean agricultural for 6-ton lots d/d nearest station, £28 10s. per ton.

Coal-Tar Products

Benzole.—Per gal, ex works: 90's, 3s. 8¼d.; pure, 3s. 11½d.; nitration grade, 4s. 2½d.

Carbolic Acid.—Crystals, 1s. 6d. to 1s. 8d. per lb. Crude, 60's, 8s. MANCHESTER: Crystals, 1s. 6d. to 1s. 8d. per lb., d/d crude, 8s. naked, at works.

Creosote.—Home trade, 10d. to 1s. 2d. per gal., according to quality, f.o.r. maker's works. MANCHESTER: 1s. to 1s. 8d. per gal.

Cresylic Acid.—Pale 99%, 5s. 8d. per gal.; 99.5/100%, 5s. 10d. American, duty free, for export, 5s. to 5s. 8d. naked at works.

Naphtha.—Solvent, 90/160°, 4s. 10½d. per gal. for 1000-gal. lots; heavy, 90/190°, 4s. 3½d. per gal. for 1000-gal. lots, d/d. Drums extra: higher prices for smaller lots.

Naphthalene.—Crude, ton lots, in sellers' bags, £18 16s. 3d. to £34 per ton according to m.p.; hot-pressed, £50 to £60 per ton, in bulk ex works; purified crystals, £68 10s. to £79 3s. 4d. per ton.

Pitch.—Medium, soft, home trade, 130s. per ton f.o.r. suppliers' works; export trade, 200s. per ton f.o.b. suppliers' port. MANCHESTER: £8 f.o.r.

Pyridine.—90/160°, 42s. 6d. per gal. MANCHESTER: 42s. 6d. per gal.

Toluol.—Pure, 4s. 7½d. per gal. MANCHESTER: Pure, 4s. 7½d. per gal. naked.

Xylol.—For 1000-gal. lots, 5s. 6d. per gal., according to grade, d/d.

Intermediate and Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—3s. 9d. per lb. d/d.

***o*-Creso** 30/31° C.—1s. 4d. per lb. d/d.

***p*-Cresol** 34/35° C.—3s. 9d. per lb. d/d.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb.; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 11d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—1s. 2d. per lb.; P.G. 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10-cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Next Week's Events

MONDAY 27 OCTOBER

The Chemical Society

Oxford: Physical Chemical Laboratory, South Parks Road, 8.15 p.m. Alembic Club Lecture. Professor Alexander Haddow: 'Carcinogenesis.'

Institution of the Rubber Industry

Manchester: Engineers' Club, Albert Square, 6.15 p.m. Dr. E. J. Buckler (manager, Research and Development Division, Polymer Corporation, Ltd., Canada): 'Physical Studies of Polymer-Plasticiser Systems.'

TUESDAY 28 OCTOBER

The Chemical Society

Leeds: University, 6.30 p.m. RIC Lecture. Professor N. K. Adam: 'Detergent Action.'

Royal Institute of Chemistry

London: Sir John Cass College, Jewry Street, E.C.3, 6.30 p.m., with the Sir John Cass College Chemical Society. Dr. S. Wernick: 'Electro-finishing of Metals.'

Iron & Steel Institute

London: 4 Grosvenor Gardens, S.W.1, 2 p.m. Joint meeting with the British Iron and Steel Research Association. Discussion on: 'The Corrosion of Steel under Phosphate Coatings and Protective Finishes.'

Institute of Fuel

London: Institution of Mechanical Engineers, Storey's Gate, S.W.1. Two-day conference on 'A Special Study of Ash and Clinker in Industry.' Two sessions each day, 10 a.m. to 12.30 p.m., and 2 to 4.30 p.m.

The Royal Institution

London: 21 Albemarle Street, W.1, 5.15 p.m. Dr. Bernard W. Bradford (associate research manager, I.C.I., Ltd.): 'Physical Chemistry in the Chemical Industry.' (First of two afternoon lectures.)

WEDNESDAY 29 OCTOBER

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. Food Group. J. D. Mounfield: 'Some Aspects of Education in Food Technology.'

Institution of Chemical Engineers

London: Graduates' and Students' Section, 8.45 a.m. Visit to Isle of Grain.

Manchester Metallurgical Society

Manchester: Engineers' Club, Albert Square, 6.30 p.m. Dr. T. Ll. Richards: 'Cold Working of Metals.'

THURSDAY 30 OCTOBER

The Chemical Society

Bristol: University, Woodland Road, 7 p.m. Bristol Section and Food Group, joint meeting with the RIC and the SCI. Dr. E. C. Bate-Smith (Superintendent, Low Temperature Research Station): 'The Work of the Food Investigation Organisation, DSIR.'

Durham: Science Building, South Road, 7.45 p.m. Joint meeting with RIC and the SCI. Professor E. D. Hughes: 'The Comparative Chemistry of Carbon and Silicon.'

Hull: University College, 6 p.m. Professor H. W. Melville: 'Recent Progress in the Mechanism of Synthesis of High Polymers.'

Royal Institute of Chemistry

Brighton: Technical College, 6.30 p.m., with Brighton Technical College Chemical Society. Professor H. C. Longuet-Higgins: 'Electron-deficient Bonds.'

Textile Institute

Kidderminster: Staff canteen, Kidderminster Carpet Trades, Ltd., 7.30 p.m. H. J. Crone: 'Man-made Fibres for Carpet Surface Yarns.'

FRIDAY 31 OCTOBER

The Chemical Society

Exeter: Washington Singer Laboratories, Prince of Wales Road, 5 p.m. Dr. A. Albert: 'The Bacteriostatic Properties of Heterocyclic Compounds.'

St. Andrews: United College, 5.15 p.m. Professor F. Challenger: 'Some Organic Compounds of Sulphur of Natural Occurrence.'

Swansea: University College, 5.30 p.m. Joint meeting with the RIC. Dr. R. Spence: 'Chemical Research at Harwell.'

Society of Chemical Industry

Glasgow: Merchants' House, 6 p.m. Tenant Memorial Lecture. Dr. A. Fleck: 'The British Sulphuric Acid Industry—In Retrospect and with a Research Prospect.'

Royal Institute of Chemistry

Cambridge: University Chemical Laboratory, 8.15 p.m. Dr. T. C. J. Ovenston: 'Byways in Absorption Spectrophotometry.'

The Royal Institution

London: 21 Albemarle Street, W.1, 9 p.m. Dr. Morris W. Travers (Professor Emeritus, University of Bristol): 'Sir William Ramsay.'

Chemical & Allied Stocks & Shares

CHEMICAL and kindred shares have moved fairly closely with the trend in industrials and were generally slightly lower on balance for the month. Imperial Chemical at 44s. 1½d. were 'ex' the 5 per cent interim dividend. The market view is that there seem good prospects of the dividend total being maintained at 13 per cent unless the directors decided to make a fresh application to the Capital Issues Committee for permission to distribute a share bonus. Monsanto Chemical 5s. shares have come back sharply to 24s. 3d. 'ex' the unchanged 6¾ per cent interim dividend, which was however, accompanied by a warning from the directors that trading profits have been materially affected by price reductions necessary to sustain turnover.

Reichhold Chemical 5s. shares changed hands around 8s. 7½d. and the 6 per cent preference shares around 19s. 9d. John & James White 5s. shares were 11s. 6d., Pest Control 5s. shares 4s. 1½d., Hickson & Welch were around 9s. 6d., Brotherton 10s. shares firm at 22s. 6d. while despite the reduction in the interim dividend from 4½ per cent to 3¾ per cent, Greeff-Chemical Holdings 5s. shares have been steady at 15s. 3d. Elsewhere, F. W. Berk 2s. 6d. shares were 6s. 6d., Boake Roberts 5s. shares 13s. 9d., and Bowman Chemical 4s. shares 5s. 9d. Amber Chemical shares were 2s. Fisons were 30s. 6d., while Albright & Wilson 5s. shares at 15s. 6d. remained firm in response to market hopes of higher dividend possibilities. W. J. Bush were 46s. 3d., while Eaglescliffe 5s. shares have been at 16s. 6d. and Laporte Chemicals 5s. shares strengthened to 11s. 1½d. In other directions, L. B. Holliday 4½ per cent preference were 15s. 9d. and British Chemical & Biologicals 4 per cent preference 14s. 6d.

Borax Consolidated showed firmness at 37s., British Glues & Chemicals 4s. shares were 10s. 9d., and Lawes Chemicals 10s. 3d., but plastics shares were not popular.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

CIVIL SERVICE COMMISSION—SENIOR SCIENTIFIC OFFICER AND SCIENTIFIC OFFICER COMPETITION 1952

NOTICE is given that all persons appointed with a certificate of the Civil Service Commissioners on or after 1st January, 1953, will be pensionable under the Superannuation Acts instead of, as hitherto, under F.S.S.U. Persons appointed in a permanent capacity on F.S.S.U. terms before that date will be given the option of either remaining on those terms or of accepting the conditions of the Superannuation Acts. Further particulars from **SECRETARY, CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1,** quoting **F.S.S.U./Amdt.**
19235/100/EP.

COMMENCING end of November. **WORKING PLANT or PROCESS CHEMIST,** under 35, British born, B.Sc. or A.R.I.C., or shortly reaching that standard, for fine chemical department, old-established company, N.W. London. Opportunity gain experience wide range products. Permanent pensionable position for right man. Particulars age, education and remuneration required, **BOX No. C.A. 3173,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

FOR SALE

COMPLETE GAS PRODUCER PLANT by International Furnace Equipment. Gasifies 100 tons bituminous fuel weekly. Storage bunker fed by belt bucket elevator. Adjustable feeding device. Electrostatic precipitator by Simon Carves. All necessary control equipment, etc. Little used.

RICHARDS TILES LIMITED, TUNSTALL, STOKE-ON-TRENT.

DELAFILA, THE INERT FILLER. Used in the manufacture of Fertilisers, Insecticides, Paints, Plastics and Insulating and Sealing Compounds. Prompt supplies in a wide range of fineness grades. **THE DELABOLE SLATE CO., LTD. DELABOLE, CORNWALL.**

DRAGON FLAME GUNS make an adaptable Portable Forge and are used extensively in boilers in conjunction with solid fuel to raise steam quickly. Excellent for heating metal, removing rust, etc. Two gallons paraffin gives two hours' burning. 2,000 deg. flame temperature. No instruction necessary. Perfectly safe. Full descriptive literature from **MORTON LONGLEY, LIMITED, 200, THE BEACON, HILLINGDON, MIDDX.**

SCREENLESS PULVERIZERS for fine grinding of Chemicals. Also CYCLONES, ROTARY VALVE FEEDERS. Callow (Engrs.) Ltd. Kirkby Trading Est., Liverpool.

FOR SALE

STAINLESS STEEL F.D.P. Quality $\frac{1}{8}$ in. thick plate, welded construction horizontal cylindrical enclosed storage tank, 2,000 gallons capacity, 6 ft. by 12 ft. long, manhole inlet and outlet connections. Further details **BOX No. C.A. 3169,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

NEW AND UNUSED PLANT

2—**STAINLESS STEEL** Cylindrical Open-top **TANKS,** 2,100 gals.
4—**ALUMINIUM** Rectangular Open-top **TANKS,** 650 and 850 gals.
4—Mitchell Tray **DRYING OVENS,** steam and electrical.
2—Vacuum **DRYING OVENS** with motorised pumps.
2—**ENAMEL - LINED** Cast - iron •Jacketed Enclosed **MIXERS** by Clark, 220 gals.
1—**STAINLESS STEEL** Jacketed **MIXER,** 550 gals.
6—**STAINLESS STEEL** Jacketed **PANS,** 1,000 gals.
2—**STAINLESS STEEL** Jacketed **PANS,** 350 gals.
Several **STAINLESS STEEL AGITATORS,** propeller or paddle type.
3—**STAINLESS STEEL** 4-in. Pulsometer **PUMPS,** motor driven.
2—**STAINLESS STEEL** 3-throw **HOMOGENISERS,** 50 g.p.m. at 2,500 lb.
2—Sharples Super **CENTRIFUGES,** No. 6.
1—48-in. Broadbent Galvanised **HYDRO EXTRACTOR,** pitless type.
3—160-gal. Rubber-lined **TANKS,** with Mitchell mixers.
31—**ALUMINIUM TUBED CONDENSERS,** 149—$\frac{5}{8}$ in. o.d. tubes, 9 ft. 10 in. long.
7—**ALUMINIUM TUBED CONDENSERS,** 386—$\frac{7}{8}$ in. o.d. tubes, 14 ft. long.
1—**ALUMINIUM TUBED CONDENSER,** 271—$\frac{3}{4}$ in. o.d. tubes, 16 ft. 6 in. long.
7—**COPPER TUBED CONDENSERS,** 300—$\frac{3}{4}$ in. o.d. tubes, 8 ft. long.
13—**EARTHENWARE JARS,** 2,000 litres and 500 litres capacity.
5—**HAVEG** Cylindrical Open-top **TANKS,** 2,750 gals.

**HUBERT JONES, LTD.,
COBDEN STREET, PENDLETON, SALFORD 6.
Tel. PEN 1373/4.**

NEWTON CHAMBERS GLEN FALLS ROTARY SULPHUR BURNER, complete with secondary combustion chamber, feed hopper and steel flue pipes. Capacity, 10 tons of sulphur per day. Purchased new 1946. The burner was in service for approximately three years. For further particulars apply **BOX NO. C.A. 3177,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

1 Barron "D" MIXER, TROUGH 30 in. by 18 in. by 18 in. Vee-belt drive to 2 H.P. motor, 750 revs. 400/3/50. As new.

One Werner Type MIXER, TROUGH 36 in. by 30 in. by 28 in. Twin "Z"-blades, power tilted, fast and loose pulley drive.

THOMPSON & SON (MILLWALL) LIMITED, CUBA STREET MILLWALL E.14. (Tel.: **East 1844)**

10 TONS of **ACTIVATED CARBON** Grade 'C.' Apply **BOX NO. 3176,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

FOR SALE

600

ROTARY DRIERS

ROTARY DRYING INSTALLATION by L. A. Mitchell, comprising Rotary Drier, 30 ft. by 5 ft. 10 in. diam., running on twin roller paths. Drive by 12 h.p. 1,550 r.p.m. motor through reduction gear to main girth gearwheel for final drum speed of 7 r.p.m. Arranged solid fuel firing, complete with combustion and air mixing chambers, fitted Mirrlees Watson underfeed stoker. Complete with exhaust fan and cyclones.

ROTARY LOUVRE DRIER by Dunford & Elliott, 25 ft. by 7 ft. 6 in. diam. M.S. shell ½ in. thick. M.S. radial louvres 3/16 in. thick. Stainless steel double tangential louvres ⅛ in.thick and stainless steel feed cone. Inside of shell and both sides double louvres sprayed 0.002 in. zinc covered by 0.006 in. aluminium. Drum carried on two roller paths and driven through girth gear and pinion from worm gear reduction box and 15 h.p. motor. Complete with inlet and outlet centrifugal fans, the exhaust fan metal sprayed and inside of casing lithcoted. PLANT NEW AND UNUSED.

ROTARY DRYING INSTALLATION by Dunford & Elliott, comprising Rotary Dryer, 20 ft. by 4 ft. 6 in. diam., running on two roller paths. Arranged 4 h.p. electric motor drive through reduction gearbox to main girth gear. Heating arrangements comprise gilled type air heater using steam at 80 lb. pressure. Complete with cyclone, 7½ h.p. motorised Sturtevant fan with 27 in. diam. by 12 in. paddle, and low velocity exhaust hood equipped with motorised fan.

GEORGE COHEN SONS & CO., LTD.,
WOOD LANE, LONDON, W.12.
Tel.: Shepherds Bush 2070 and
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ECONOMIC BOILERS—9 ft. diam. by 12 ft. 6 in. Foster Yates, 200 lb. w.p.; 8 ft. diam. by 14 ft. Paxman, 180 lb. w.p.
NEW GALVANISED PIPING. Immediate delivery.
Johnson Filter **PRESSES,** 25 in., 18 Frame, practically new.
FIVE new **FURNACE RETORTS,** 8 ft. diam., 6 ft. 8 in. deep, approx. 8 tons each. Welded Steel.
BENZOLE WASHER, lead lined, agitating gear, 7 ft. diam., 6 ft. 6 in. deep.
FIVE Dish-ended **NAPHTHA TANKS,** 18 ft. 6 in. long by 4 ft. 4 in. diam., two having agitators.
NINE New Welded **TANKS,** 13 ft. 6 in. long, 7 ft. diam., 3,100 gallons each.
TWO 35 ft. long by 9 ft. diam. Lead-lined **TANKS.**
Stainless Steel **FILTER TANK,** 3 ft. 6 in. diam.
ONE Stainless **CONICAL HOPPER,** 7 ft. 3 in. diam., overall depth, 7 ft. 6 in.
TWO Broadbent **WATER-DRIVEN CENTRIFUGES,** 30 in. diam., 12 in. deep, 1,150 r.p.m., 150 lb. pressure.
FOUR Papier-mache O.T. **TANKS,** 8 ft. 3 in. diam., 9 ft. deep. (Unused.)
SIX O.T. **TANKS,** 7 ft. diam. 14ft. deep, lined inside with acid-resisting bricks.
SIX Aluminium **CONDENSERS,** 14 ft. long by 2 ft. 6 in. diam. 386 Tubes, ⅞ in. o.d.
FOUR Rectangular Lead-lined **TANKS,** 8 ft. by 4 ft. 6 in. by 2 ft. 6 in.
FORTY Riveted **RECEIVERS,** 8 ft. 6 in. long, 5 ft. 6 in. diam., 75 lbs. w.p.
CAST-IRON PIPES, 5000 ft. Each 6 in. and 8 in.
VALVES in Stainless, Gunmetal, Enamel Lined.
Free Catalogue, " Watkins Machinery Record," available

FRED WATKINS, COLEFORD, GLOS.

FOR SALE

VARIOUS MIXERS FOR SALE

ONE 1¼ size Harrison Carter **DISINTEGRATOR.** Enclosed **STORAGE TANK,** 5 ft. 8 in. by 11 ft. 8 in. by 10 ft., deep, in Buckingham.

Two Miracle No. 1 size **HAMMER MILLS,** belt driven, with fans and cyclones.

Three Perplex-type **IMPACT GRINDERS,** 24 in. and 30 in. circular grinding chambers.

Two Turner 2½-sheet No. 2 **DRESSING MACHINES,** ball bearing.

Size No. 3 Junior Hammamac **HAMMER MILL** with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS.**

Robinson 3-sheet No. 1 size **CENTRIFUGAL DRESSING MACHINE** for dry powders, etc.

Two **ROTARY BOWL MIXERS.** 5 ft. diam., cast-iron built, inclined agitators by Baker Perkins

One excellent **EVAPORATING UNIT,** comprising Copper Vessel, 4 ft. diam. by 5 ft. 6 in. deep, jacketed on the bottom, with copper swan-neck, C.I. catch-pot, vacuum pump and fittings including thermometer and gauge.

Large unjacketed **WERNER MIXER.** belt and gear driven, hand tipping, double " Z " arms, pans 31 in. by 45 in. by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR.** Low type, with C.I. built mixing chamber. 28 in. by 29 in. by 27 in. deep, with double " U "-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6ft. by 4 ft. high to the top of the tipping screw

No. 209 One **HORIZONTAL " U "-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

One **FILTER PRESS,** fitted 68 wood recessed plates, 2 ft. 8 in. square, centre fed, with enclosed bottom corner delivery, cloth clips and belongings.

One **DEHNE FILTER PRESS,** cast-iron built, fitted 45 recessed ribbed plates, 2 ft. 8 in. by 2 ft. 8 in. by 1¾ in., with bottom corner feed, cloth clips and bottom corner separate outlets, angle lever closing gear, etc.

SIMON HORIZONTAL TUBULAR STEAM-HEATED DRIER, barrel with steam-heated tubes, 12 ft. long by 5 ft. diameter.

Further details and prices upon application.

Write **RICHARD SIZER LIMITED, ENGINEERS, CUBER WORKS HULL**

FOR SALE

MORTON, SON AND WARD, LIMITED,
offer
HYDRO EXTRACTORS

BY **BROADBENT**—all electric, under-driven:

ONE 48 in. pit type, 3-point suspension, steel galvanised basket, lift-out type.
ONE 48 in. pit type, 3-point suspension, steel galvanised basket.
ONE 48 in. pit type, 4-point suspension, stainless steel imperforate basket, complete with skimming attachment, A.C. or D.C.
ONE 60 in. pit type, 3-point suspension, steel galvanised basket.
ONE 72 in. pit type, 3-point suspension, steel galvanised basket.
ONE 72 in. pitless type 3-point suspension, steel galvanised basket.

By **WATSON LAIDLAW**—
TWO 42 in. 3-point suspension, under-driven through Vee ropes from flange-mounted vertical spindle motor.

By **MANLOVE ALLIOTT**—
ONE 21 in. imperforate conical basket, 21 in. tapering to 12 in. at bottom. Under-driven through flat belt from flange-mounted vertical spindle, 2 h.p. motor.

ALL THE ABOVE ARE SUITABLE FOR 400/3/50 SUPPLY AND ARE COMPLETE WITH STARTING EQUIPMENT.

By **BROADBENT**—Steam-driven:
ONE 48 in. copper basket, 3-point suspension.
ONE 48 in., as above, but lead lined throughout and ebonite-lined basket.

JACKETED BOILING PANS

NEW 100g., 150g. and 200g. in mild steel, suitable for 80/100 p.s.i. w.p.
SECOND-HAND, one 200g. in cast iron, arranged with nickel-chrome mixing gear, totally enclosed, fume-tight cover.
ONE 1,500g. in mild steel, second-hand.
SEVERAL 40/60g. second-hand, in mild steel and cast iron available.
All the above can be fitted with mixing gear to requirements.

PUMPS

A large selection of **PUMPS** in stock—**MONOS, DRYSDALES**, etc.—1 in. 2 in., 3 in., 5 in. and 6 in. New and second-hand.
Numerous all-bronze, brass tube, **CONDENSERS** or **HEAT EXCHANGERS** by Serck in stock.

INQUIRIES INVITED.

MORTON, SON AND WARD LIMITED,
WALK MILL,
DOBCROSS, NR. OLDHAM,
LANCS.
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GRAVITY Roller Conveyor several lengths, Rolls. 2½ in. diam. by 16 in. 3 in. centres. Good condition. **THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET MILLWALL E.14.** (Tel.. East 1844.)

CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal-insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH LONDON," TELEPHONE 3285 EAST.

FOR SALE

PHONE 98 STAINES

TWIN **Z-BLADE MIXERS**, 36 in. by 30 in. by 26 in., 21 in. by 21 in. by 17 in. and 16 in. by 16 in. by 14 in.; also Laboratory sizes.
Jacketed Cylindrical **MIXERS**, 8 ft. 6 in. by 5 ft. 9 in., 3 ft. 6 in. by 3 ft. 6 in. and 2 ft. by 2 ft.
Two **U-TROUGH MIXERS**, 6 ft. by 2 ft. by 2 ft.—400/3/50.
"**WERNER**" Jacketed **FIN-BLADE MIXERS**, up to 3 ft. by 2 ft. 6 in. by 2 ft. 6 in.
Unused **CALORIFIERS**, also "WEIR," "SERCK" and all-aluminium **CONDENSERS**, 245 and 130 sq. ft. tube area.
Unused 4,000-gal. **TANKS**, 15 ft. by 7 ft. by 7 ft., $\frac{5}{16}$ in. plate (Enclosed.)
"**COCHRAN**" **BOILER**, 9 ft. by 4 ft., 850 lb. evap. 100 lb. w.p.
PUMPS, HYDROS, FANS, STILLS, DRYERS, OVENS, etc.
Send for lists of **MIXERS, TANKS, RADIATORS.**

HARRY H. GARDAM & CO., LTD., STAINES.

TRANSLATIONS

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